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MARKET ANALYSIS AND CONSUMER IMPACTS SOURCE DOCUMENT

Part I The Motor Vehicle Market in The Late 1970's

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U.S. DEPARTMENT OF TRANSPORTATION
Research and Special Programs Administration
Transportation Systems Center
Cambridge MA 02142

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16. Abstract

This source document on motor vehicle market analysis and consumer impact consists of three parts. Part I is an integrated overview of the motor vehicle market in the late 1970's, with sections on the structure of the market, motor vehicle trends, consumer trends, and market outlook. Part II consists of studies and reviews on: motor vehicle sales trends; motor vehicle fleet life and fleet composition; car buying patterns of the business market; impact of downsizing on automotive preference of new car buyers; demand for light trucks, recreational vehicles, used cars, and station wagons; and consumer expenditures for private motor vehicle transportation. Part III consists of studies and reviews on: consumer awareness of fuel efficiency issues; consumer acceptance of fuel efficient vehicles; car size choices; passenger car choices; truck choices; and motor vehicle usage trends.

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PREFACE

This report, DOT-TSC-NHTSA-80-2.I "Market Analysis and Consumer Impacts Source Document," summarizes the studies and reviews on the motor vehicle market of the 1970's which TSC has performed during the past two years as part of its support to the NHTSA Automotive Fuel Economy Program.

The source document is presented in three parts. Part I is an integrated overview of the motor vehicle market in the late 1970's. Part II is a series of reviews of the motor vehicle market and consumer expenditures on motor vehicle transportation. Part III is a series of reviews of behavioral and attitudinal studies on the consumers of motor vehicle transportation.

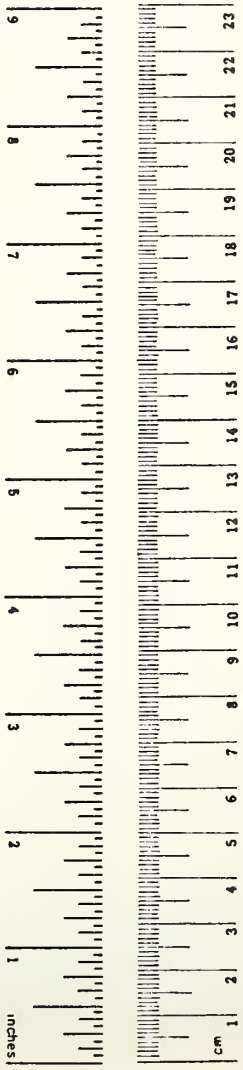
This document is deliverable under PPA HS-163, "Support for Research and Analysis in Auto Fuel Economy and Related Areas."

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

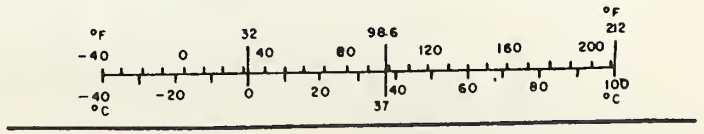
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	he
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teespoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



MARKET ANALYSIS AND CONSUMER IMPACTS
SOURCE DOCUMENT

PART I THE MOTOR VEHICLE MARKET IN THE LATE 1970's

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MAJOR FINDINGS

During the 1970's, the American consumer had an increasing need to own and drive motor vehicles. This increased demand for motor vehicles in an environment where real median household income remained stable appears to be connected to the increase in employment, particularly the increased employment of women of child bearing age.

This increased need for motor vehicles was met by the average American household through the driving of slightly older vehicles and the allocating of an increased proportion of its expenditures to private motor vehicle transportation. The expenditure allocations for new motor vehicle purchases peaked in 1972-73. In the post-recession years of 1976 through 1978, they were about 5 to 10 percent below this peak.

In spite of these conservative expenditure allocations by the personal consumption sector, total new motor vehicle sales, cars and light trucks, enjoyed an average annual growth in sales of 3 percent. This growth rate, although well below the growth rate of the registered fleet, still outpaced the growth in population, potential drivers, household formation, and real income. Total new motor vehicle sales in both 1977 and 1978 topped the 1973 sales, the previous peak.

During the 1970's, the trend among new motor vehicle buyers was away from large sedans and station wagons, and toward light trucks and smaller sedans and wagons. This trend antedates the Arab Oil Embargo of 1973-74, although it accelerated considerably in the post-embargo years. Between 1971 and 1978, large cars and station wagons had their market share halved. About two-thirds of this decline in shares went to light trucks and one-third to smaller cars. From consumer behavioral and attitudinal studies, it appears that this shift was caused, at least in part, by economic considerations. In general, trucks and vans were often less expensive to own and operate than sedans and station wagons.

During the 1970's, the trend to light truck was restricted nearly exclusively to households that owned two or more vehicles. Thus, the pickup and the van were usually "second" and not primary vehicles. Pickups, particularly, were praised for their versatility; they were typically bought to fulfill multiple, unrelated purposes.

Economic considerations were apparently also responsible for consumers' avoidance of catalyst-equipped vehicles (both cars and light trucks) which require the more expensive unleaded gasoline. This avoidance occurred both through pre-purchase and through vehicle size class selections.

The new passenger car models, which the industry designed with emphasis on fuel efficiency improvements, were generally well received in the market. This market trend was fully consistent with consumers' conservative expenditure allocations to the purchase of new motor vehicles.

Although there were great variations among consumers, with a few clearly desiring the largest and most gas guzzling cars available for reasons of prestige and self-gratification, the average consumer preferred an intermediate sized car and had a rather utilitarian approach toward motor vehicle ownership, as of 1978 when the research was conducted.

Most consumers were also conservative in their demands for acceleration. Behavioral studies of 1978 showed the readiness of consumers to sacrifice acceleration for fuel economy.

Attitudinal studies of late 1978 showed that consumers generally were willing to accept downsizing. However, there was strong resistance to material substitution, particularly plastics. This appeared to be associated with a cheapening of the car and safety factors. Consumers were highly desireous of driving a vehicle they considered to be safe. For some, safety derived from maneuverability, for others (pickup drivers), from sitting above the traffic; but, for most, safety came from the solid construction and weight that surrounded them. There were clearly many large car owners, particularly older people, who owned these cars not because of their roominess or prestige, but because of their massiveness and the feeling of safety in an accident.

1. INTRODUCTION

1.1 GENERAL

One approach to the understanding of today's motor vehicle market is to place the market into its broad historical perspective and then to analyze it against this perspective. (See Table 1-1 for some of the recent automotive related events.) Until about a decade ago, it was the general American public policy, with strong popular support, to create an environment in which people could make the maximum use of motor vehicles. Thus, local and federal legislatures passed acts that led to the grading and paving of the street and road networks, then, step by step to road-widening, road alignments, parkways, by-pass roads, turnpikes, and, finally, in 1956, to Congress' authorization of the Interstate Highway System.

Parallel with these developments came other economic pressures and public policies which favored the development of the suburban rings over the central cities and rural America. Here, a life style was developed that demanded private motor vehicle travel. By 1970, over 82 percent of all U.S. households owned automobiles, and 35 percent owned two or more cars. In the suburban ring, automobile ownership was even greater; here, over 90 percent of all households had cars, and 45 percent had two or more cars.[1*]

With this near universality of automobile ownership, the attitudes toward automobiles began to change. For most, the car was now a practical necessity; its status as a macho symbol declined. Thus, questions could be asked about its safety, its emissions, and its fuel consumption.

*Superscripts refer to references listed in Appendix A.

TABLE 1-1. MAJOR AUTOMOTIVE RELATED EVENTS DURING THE 1970s

1970	• Clean Air Act Amendments of 1970, which set emission standards for motor vehicles.
1973-74	• Arab-Israeli War (October) followed by Arab Oil Embargo with resultant gasoline shortages between December and March, and permanent 40% rise in gasoline prices.
1974	• First Quarter: Severest post-World War II economic recession begins.
	• Fall: More stringent EPA, NOx emissions standards take effect, resulting in the introduction of unleaded gasoline required by catalytic converters in most 1975 Model Year vehicles with GVW of less than 6,000 lbs.
1975	• First Quarter: Economic recession reaches its bottom.
	• December: The Energy Policy and Conservation Act of 1975 is enacted. This Act includes motor vehicle fuel economy standards, and authorizes the setting of additional standards.
1976	• Fall: GM introduces the downsized version of their full-sized cars (Model Year 1977).
1977	• March: Light truck fuel economy standards set by DOT for Model Year 1979 light trucks.
	• July: Fuel economy standards set by DOT for Model Year 1981-1984 passenger autos.
1978	• January: Chrysler introduces the new subcompacts Dodge Omni and Plymouth Horizon.
	• March: Light truck fuel economy standards set by DOT for Model Year 1980 and 1981 light trucks.
	• June: Gasoline prices begin to rise.
	• EPA's NOx emissions standards become effective for light trucks 6000 to 8500 lbs GVW - beginning with 1979 Model Year.
	• Ford and Chrysler introduce downsized versions of their full-sized cars for the 1979 model year.
1979	• January: Iranian Revolution resulting in cut off of Iranian Oil from world market.
	• Spring: Rise in gasoline prices accelerates.
	• April: GM introduces new front-wheel-drive X-Body compacts.

1.2 SAFETY

Automobile traffic accidents and fatalities are a problem as old as the car itself. Until the mid-1960s, it was usually assumed that the major reasons for traffic accidents were high speed, poor vehicle and tire maintenance, and lack of driving skill. Thus, highway improvements, safety inspections, defensive driving, and driver training were thought to be effective means for solving the accident problem. With the publication of Nader's Unsafe At Any Speed[2] and the hearings before Senator Ribicoff's subcommittee, there evolved a general awareness that safety was, in addition, a function of basic automobile design. In 1966, Congress enacted the National Traffic and Motor Vehicle Safety Act, and established the National Highway Traffic Safety Administration with the authority to set safety performance standards for motor vehicles and related equipment.

1.3 EMISSIONS

One of many reasons for the move to suburbia had been the desire to exchange the "dirty" city with coal particulate pollution for the clean air of suburbia. However, it soon became clear, first in Los Angeles, then in all of California, and finally in the rest of the nation, that particulate pollution had been exchanged for chemical pollution, and that the automobile was the major cause of these chemical pollutants. Automobile-generated air pollution first emerged as a significant national political issue in the mid-1960s, and led, in 1969, to the passage of the National Environmental Policy Act and, in 1970, to the Clean Air Act Amendments, which set stringent new car emission standards beginning with the 1975 Model Year.

1.4 FUEL CONSUMPTION

In the decades before the Arab Oil Embargo, American-built cars averaged less than 14 miles per gallon, while the imports had gas mileages in the mid-20s.[3] This discrepancy made the automobile a prime target for energy conservation after the 1973 Oil

Embargo, when public policy was searching for ways of making America less dependent on foreign petroleum sources. In 1975, Congress passed the Energy Policy and Conservation Act which set passenger automobile fuel economy standards for Model Years 1978, 1979, 1980, and 1985, and authorized the Department of Transportation to establish standards for Model Year 1981 through 1984 cars and for light trucks from Model Year 1979 on (See Tables 1-2 and 1-3). These fuel economy standards are "Corporate Average Fuel Economy" (CAFE) standards. This means the standards require, with financial penalties, that all the vehicles produced in one model year by a manufacturer meet these standards collectively. A corporation is in compliance with the law if some of the vehicles it produces fall below the standard, as long as the fleet average meets the standard.

1.5 CENTRAL MARKET ISSUES

Through the safety, emission, and fuel economy standards, public policy is setting major specifications for motor vehicles to make them acceptable to national priorities. These specifications require the manufacturers to make extensive development and production investments without any assurance that these redesigned products will be accepted in the market place.

The standards, therefore, raise the central market issue of the late 1970s and 1980s:

> DO THE PURCHASERS OF MOTOR VEHICLES ACTING INDIVIDUALLY IN THE MARKET PLACE SUPPORT THE SPECIFICATIONS REQUIRED BY THEM, COLLECTIVELY, THROUGH THEIR REPRESENTATIVES IN CONGRESS?

From a policy analysis point of view, this market issue raises the correlative issue:

> WHAT ARE THE IMPACTS OF THE LEGALLY REQUIRED SPECIFICATIONS ON THE CONSUMING PUBLIC?

TABLE 1-2. CORPORATE AVERAGE FUEL ECONOMY (CAFE) STANDARDS FOR PASSENGER CARS

MODEL YEAR	FUEL ECONOMY STANDARD
	Miles per gallon
1978	18
1979	19
1980	20
1981	22
1982	24
1983	26
1984	27
1985	27.5

TABLE 1-3. LIGHT TRUCK FUEL ECONOMY STANDARDS (MPG)

YEAR	2WD[1,2]	4WD General Utility	2WD[3]	4WD[3]	Limited Product Line[4]
1979	17.2	15.8	-	-	-
1980	-	-	16.0	14.0	14.0*
1981	-	-	16.7	15.0	14.5

Footnotes:

2WD = 2-wheel drive

4WD = 4-wheel drive

(1) Captive imports included for domestic manufacturers.

(2) All 4WD vehicles, including general utilities, may be included in this class.

(3) Captive imports not included for domestic manufacturers.

(4) Applies to manufacturers using truck engines only.

From TSC's reviews and studies to date, this part of the source document attempts to give an integrated answer to these central market and consumer impact issues with respect to fuel efficiency. Safety and emission standards are dealt with only in so far as they impact the market for fuel efficient vehicles.

As will become apparent, the general finding of the reviews and studies is that, on balance, the market has accepted the fuel efficient vehicles, and, with certain exceptions, the impacts on the consuming public have been positive.

2. THE STRUCTURE OF THE MOTOR VEHICLE MARKET

The structure of the motor vehicle market, as the structure of any market, is determined by three basic factors:

a. The product that is sold,
b. The demand for the product, and
c. The socio-economic-political environment in which the market operates.

In this section, the emphasis will be on the influences which the products (new automobiles and light trucks) and the demand for personal consumption exercise on the structure of the motor vehicle market.

2.1 THE PRODUCT

The central products of the motor vehicle market are new automobiles and new light trucks. These products have four characteristics, each of which has direct bearing on the structure of the market. These four characteristics are:

a. The product is mass produced,
b. The product is customized (it has accessories and options),
c. The product is high-priced, and
d. The product is mechanically complex and requires service.

2.1.1 Mass Production

Until Henry Ford began assembly line production of automobiles and halved their prices, the automobile was beyond the means of the average household. Mass production and assembly line techniques are absolutely essential for the economic production of automobiles. However, mass production techniques carry with them certain limitations on the manufacturer.

a. Economy of Scale. To attain the full benefits from mass production processes, a certain number of cars must be produced by an assembly plant in any one year. To produce fewer will lead to higher production costs, and to produce more will generate no lower costs. TSC estimates that about 270,000 units per year is the most typical level for assembly plant production rates.

b. Lead Time. Producing a new motor vehicle design takes considerable lead time. Depending on the changes which are implied by the new design, lead times can vary from 18 months to 4 years.

Because of these two limitations in mass production, the motor vehicle manufacturer can make major responses to new market opportunities only with relatively long lead times and high capital investments. Furthermore, these limitations imply that manufacturers desire to be rather certain of the demand for new products before they invest in them. The case of the "Edsel" which bombed in the market is an ever-ready example against taking risks. The Edsel required sales of 200,000 cars per year to break even, but sold only 106,000 units in slightly over two years of production. According to L.B. White, Ford lost over $100 million on the venture.[4] These high risks make product marketing of the major automobile companies conservative, rather than innovative and experimental. Manufacturers are also slow and uncertain in their responses to consumer demands which require major capital investments.

2.1.2 Options and Accessories

Although the manufacturers assemble an essentially standard product, the assembly lines are adjusted so that a wide variety of options can be introduced into the assembly process. The same basic vehicle can be produced with different engines, transmissions, suspensions, power options, air-conditioning, trims, colors, and other options and accessories.

There are many reasons why cars are offered with a wide variety of options and accessories. The most central is Alfred P. Sloan, Jr.'s policy of "a car for every purse and purpose".[5] Mass production standardizes the car; options and accessories permit a wide variety of luxury and price differences within this standard basic product. Thus, options and accessories are a way to adapt the market to minor changes in consumer demand.

Options have been a major feature of the automobile market whenever pure fascination with owning a car was not sufficient to sell anything with four wheels and an engine. The Model T, which came in every color as long as it was black, sold well in the pre-1920 market, when new car sales increased sharply year by year and were only limited by wartime supply restrictions. Model T sales began to flounder in the 1920's when car sales became cyclical, and a substantial used car market had come into existance. Likewise, the basic Volkswagen Beetle sold well in post-World War II car hungry Europe until European car sales became cyclical, and in the United States until the sale of import cars became cyclical. Today, the VW-Beetle is no longer sold in the United States or manufactured in Europe, but it is still produced and sold in Central and South America where the growth rate of automobile ownership is high.

Since options and accessories can account for up to half of a car's sticker price, the manufacturer can sharply vary the price of the cars which are produced against inventory. Particularly if a car model is in short supply, the manufacturer can increase the sticker price of the car by producing a higher proportion of more "loaded" cars. If car sales generally are sluggish, the manufacturer can decrease the sticker price by offering a large proportion of less-loaded cars, or, by using "free" option packages as special price concessions. Since nearly half of all cars are produced against buyer orders, the wide option selection permits such buyers to adapt, to a degree, their purchases to their specific needs. They can obtain stripped cars, as well as cars with relatively unique options and option combinations which are not produced against inventory.

Critics of the automobile companies frequently protest Detroit's failure to produce more readily available stripped, basic (meaning inexpensive) automobiles. This criticism, however, overlooks the fact that in the motor vehicle market, which is essentially a replacement market, consumers have the choice of buyin a new motor vehicle or a late model used one. The cost conscious motor vehicle buyer can buy either a late model used car with average accessories or a new car which is stripped. Since both vehicles are expected to be traded before scrapping, and the depreciation rate in the first years of vehicle life is high and particularly high for stripped cars, the economic (cost minimization) buy decision is often the late model used car with average options and accessories and not the stripped new car.

Still, for buyers who expect to keep their vehicle for its total useful life, as for instance utility and government fleet operators, the economic buy decisions are for vehicles with only those options and accessories essential for the buyers' operations.

2.1.3 High Priced Items

For many families, the purchase of a new motor vehicle is their largest single expenditure, except for the purchase of a home. The fact that the motor vehicle is such a large expenditure item has implications for both the buyer and the seller and, thus, the structure of the market.

To meet the expenditures, buyers tend to use trade-ins and loans to finance their purchases. Because of the high value, sellers cannot afford to reprocess their excessive inventories, but have to find a market for all their vehicles. This need to clear the market requires that motor vehicle transactions are at variable prices, and not at fixed prices.

2.1.3.1 Financing: Very few cars are purchased for cash only. Over three-fourths of all new car purchases involve trade-ins, and about three-fifths involve financing. There is a distinct desire by many purchasers to pay cash for a car, rather than finance it.

This is indicated by the fact that larger and higher priced sedans are less likely to be financed than subcompacts and low cost imported sedans.[6] On the other hand, financing distinctly broadens the market for new cars.

2.1.3.2 Inventory Clearance: In general, every motor vehicle produced and placed on the market is sold. The sale may take time and require that the price be lowered, but, eventually, the sale will occur. Typically, a model year run is sold over a period of 16 to 20 months. However, for some model years, as for instance 1973, it took over two years to sell out the model year.[7]

2.1.3.3 Variable Price: As with any large expenditure, buyers and sellers try to bargain about the transaction price. Motor vehicles are not sold at a fixed price, but at a price that varies from transaction to transaction, and at a price which is not well determined or clearly known to the buyer or to the seller. This state evolves from the fact that the "sticker" price is only a suggested retail price (see the General Motors advertisement reproduced as Figure 2-1) and that the transactions usually involve the trade-in of an old car. It is customary to grant discounts from the sticker price of the new vehicle by over-estimating the value of the trade-in. Dealers can also add to the sticker price with dealer preparatory charges.

The need to clear the market and the variable pricing have one important side effect for those who analyze and project the market. Mathematical models and analyses which estimate demand on basis of sales at fixed sticker prices under-estimate the demand for popular vehicles and over-estimate the demand for slow clearing models. These models and analyses, in essence, match the demand to the supply, and reflect changes in demand only to the extent that these changes are reflected by the manufacturers' production adjustments.

WHAT "STICKER PRICES" REALLY MEAN

HOW TO GET THE BEST BUY ON THE CAR THAT'S BEST FOR YOU.

Every GM dealer is an independent businessman. No one can tell him what to charge. Not the government, and not the manufacturer.

But the government can and does require that manufacturers post a suggested retail price, or "sticker price," on every new car we build. It's a good idea, because it makes it easier for you to compare one car against another.

Remember, the "sticker price" is only the suggested price. The actual selling price may be different. That's because the law of supply and demand affects the prices of cars, just as it affects most other prices. And market conditions change all the time.

For example: a very popular model may sell at the suggested price, but frequently cars will sell for less, because the automobile business is highly competitive.

The difference between the "sticker price" and the wholesale price—that's what the dealer pays us—is called the markup, or dealer's discount. This changes from time to time, but as a general rule the markup on small cars is lower than on full-size cars.

The dealer's markup helps to pay his rent, taxes, salaries, utility bills—all that it costs to run a business. And he also has to make a profit, or he can't stay in business. Last year, GM dealers reported about two cents profit on each dollar of sales. As you can see, competition doesn't leave the average dealer a very big margin of profit.

You can affect the price you pay. It depends on the marketplace, for one thing. You may get a bigger break if you choose a slower-selling model or a car the dealer already has in stock. The latest sales figures published in many newspapers will give you some idea of how cars are selling, although the demand for a particular model may be greater or less in your area.

How much optional equipment you order on your car also makes a big difference in its price. Go over the list carefully, and equip the car just the way you want it. Then it will have most value for you, and you'll enjoy it more. You shouldn't buy what you won't use, although much of the equipment you add to your new car will make it worth more when you decide it's time to trade it in.

Most buyers trade in a used car when they buy a new one. And the value of used cars varies according to demand as well as to their condition. Performance and appearance count, so it's a good idea to maintain your car and keep it clean. The more you can get for your old car, the less will be your out-of-pocket cost to replace it with a new one.

But whichever car you choose, the price should never be your only consideration. The dealer's reputation and his service capability are also important.

Our interest is in helping both you and the dealer to get a fair deal. We want you to be satisfied with your car. That's good for you, good for the dealer, and good for us.

This advertisement is part of our continuing effort to give customers useful information about their cars and trucks and the company that builds them.

General Motors

People building transportation to serve people

Source: Ward's Auto World, February 1979, p. 82

FIGURE 2-1. CUSTOMER INFORMATION FROM GENERAL MOTORS

2.1.4 The Product Requires Service

Motor vehicles are mechanically complex devices that require service both before and after delivery to the customer. The pre-delivery service, or dealer preparation, is an inspection of the vehicle where, hopefully, all defects not previously detected are fixed. As part of this service, "dealer installed" options are added to the vehicle, and the vehicle is cleaned and washed. After delivery, the vehicle requires service to fix defects that are covered by manufacturer warranties, to perform routine maintenance, and to repair the vehicle as need arises. Many of these services will require replacement of parts, and, often, these parts are unique to the specific make or model.

This need for service has definite impacts on the structure of the motor vehicle market. Motor vehicles are sold through franchised dealers who have service departments. With few exceptions, the dealers are independent businesses. Motor vehicles are not mass merchandise. Sears, Roebuck and Company's entry into the new car business with the Henry-J was a failure.

Because of this need for service, motor vehicle dealers must be located near the buyers. According to a 1955/56 Chicago study reported in L.B. White,[8] buyers tend to purchase their cars from the dealer of their make located closest to their home, and less than 20 percent visited dealerships further than five miles away. With the continuing suburbanization of the past two decades, this distance has probably increased, but the point remains. Because of the need for service, buyers tend to purchase their vehicles where they live. The fact that certain makes, particularly imports, are more frequent in one area than another, is probably best explained by the availability of dealerships. However, dealerships do not explain the regional difference by body style, as, for instance, the great regional differences in truck ownership.

2.2 THE DEMAND

The structure of the motor vehicle market is affected by the nature of the demand in at least four ways:

a. The demand is dispersed,
b. The demand can be diverted to used motor vehicles,
c. The demand can be timed, and
d. The demand is cyclical.

2.2.1 The Demand is Dispersed

The demand for motor vehicles is distributed nationally. Motor vehicle owners live everywhere: in large and small cities, in the suburbs, in villages and towns, and in the open country. Nearly everywhere, over 80 percent of all households own motor vehicles. The one exception is in the larger, older, central cities where other means of transportation are also available. This geographic dispersion of ownership, together with the required proximity between buyer and dealer, requires that dealers be located in every part and corner of the country.

2.2.2 The Demand Can Be Diverted

Buyers who find the new motor vehicle too expensive or otherwise unsatisfactory to their tastes, can purchase used motor vehicles if they prefer. In other words, the need for private transportation can be satisfied either through the purchase of new or used motor vehicles. This relates the two markets. A further inter-relationship between the two markets arises from the fact that trade-ins are involved in most new motor vehicle purchases.

When there is a great demand for new motor vehicles, dealers take in many used cars and the supply of used cars increases. This, however, depresses used car prices, which, in turn, lowers the true trade-in allowance a dealer can offer, and raises the cash (including financing) the new car buyer has to generate. Conversely, if new motor vehicle sales are sluggish, few trade-ins are generated, used car prices increase, dealer allowances for

trade-ins rise, and the cash requirement of new car buyers decreases. The used car market has, thus, a stabilizing effect on price and demand fluctuations in the new car market.

Most new motor vehicle dealers also deal in used motor vehicles. This broadens their potential market and permits them to serve the buyer who is vascillating between a new and a used motor vehicle purchase; again, a method that stabilizes the market. It is also a method that permits dealers to dispose of their trade-ins in the most profitable manner, i.e., by retailing them.

Trade-ins that cannot be disposed of through the dealer's retail operation are usually wholesaled through used car auctions. The prices paid at these auctions (which are a matter of public record) reflect relatively free and unmanipulated market prices since there are many sellers and buyers at these auctions, and no one dealer or group of two or three dealers can dominate the market. As a result, the relative shift in these prices month by month is a better indicator of the free demand-supply relationship by type of vehicle than new car sales and sticker prices.

2.2.3 The Demand Can Be Timed

Most motor vehicle purchases involve a trade-in, and, thus, are made to replace another motor vehicle. For example, if their vehicle is in need of repair, potential buyers have the option to either repair their vehicle or to replace it. Owners commonly go through a series of repairs on their present vehicle before they decide to replace it. In deciding on replacement, most owners consider both the cost to repair and the reliability of the vehicle (how frequently it does not start, the times the vehicle has to be taken in for repairs, etc.). Since both factors play a part in the replacement decision, there is usually no clear or specific time at which the vehicle is replaced. Thus, conditions favorable to replacement may lead to an earlier replacement than "normal," and conditions unfavorable to replacement may lead to replacement later than normal.

It appears that the EPA regulations, at various times, have led to anticipatory buying. The upsurge in auto sales at the end of the 1974 Model Year was probably, to some extent, anticipatory buying before the stiffer 1975 emissions standards went into effect. Likewise, the excellent sales of Model Year 1978 Class II trucks which operate on regular gasoline were probably, in part, stimulated by anticipatory buying since it was known that the Model Year 1979 Class II trucks would have catalysts and would operate on no-lead gasoline (see Part II, Section 1 and 5).

Postponement of the purchase decision tends to occur during recessions or whenever the economy shows signs of weakness. However, since personal expenditures for new automobiles are a major economic indicator of the current state of the economy, the two events are more auto-correlated than causative.

Postponement of the purchase decision can also occur if owners do not like what is being offered. In focal group discussions (see Part III), owners of large vehicles repeatedly state that they will hang on to their present vehicles if cars are downsized or otherwise do not meet their expectations. While many people will voice this opinion, will they in fact exercise it, and how long can they expect to stay out of the market?

That people can postpone new car purchases and will do so at least for a short period of time is apparent from the Spring 1979 motor vehicle market. Under the aegis of gasoline shortages, total new motor vehicle sales were weak. Meanwhile, small car/truck sales were not just good, but were booming and gave every indication of being supply limited, while large car/truck sales had fallen off sharply. It seems that some people who, in the past, were potential large car/truck buyers were postponing their purchases. Still, the group that was voluntarily postponing their purchases may have been quite small, since an undefined number of these postponed sales represent buyers that were waiting for delivery on their small car/truck orders.

In evaluating the actual extent to which postponement is a real threat, it is also necessary to recognize the new model buyer syndrome. Green and Rogers[9] have shown that the demographics of buyers of radical new models (e.g., the downsized 1977 GM cars) differ from the demographics of people who will buy the same type of vehicle in its second or third model year, i.e., after the "bugs are out." While some people strive to be the first ones with the new model car, others clearly shy away from such purchases, and these others are in the majority. In the focal group research (see Part III), this attitude became very clear when people discussed diesel engines. The idea seemed alright, but they surely did not want to be the first ones to own such cars.

People who do most of their own maintenance can postpone the purchase of a new motor vehicle for many years. Still, such a response by a sizable proportion of the owners lasting several years appears unlikely unless it is accompanied by a simultaneous reduction in the registered fleet or a sharp decrease in driving. The reasons are as follows:

a. Increased Maintenance: The registered fleet will require more maintenance as it becomes older, and, thus, an expansion of qualified automobile mechanics and service facilities will be required. While this can occur over time, it cannot occur suddenly. In the near term, owners will have to wait longer to obtain service, and, probably, will have to pay more for it. These are two conditions which make owners re-evaluate their repair/replace decisions in favor of replacement.

b. Used Car/New Car Price Ratios: If a sizable proportion of the owners postpone their new motor vehicle purchases, used car prices (trade-ins) will rise, and new car prices will decline. This makes the replacement decision economically more attractive.

In summary, owners can time their replacement purchases in the short run of one to two years, leading to sharp sudden increases and declines in the demand for motor vehicles. Because of the countervailing market forces, extensive anticipatory buying or a long term-postponement is unlikely. Still, short run post-

ponement can amount to a substantial deviation from the total motor vehicle sales trend and, thus, have a not insignificant impact on the industry.

2.2.4 The Demand is Cyclical

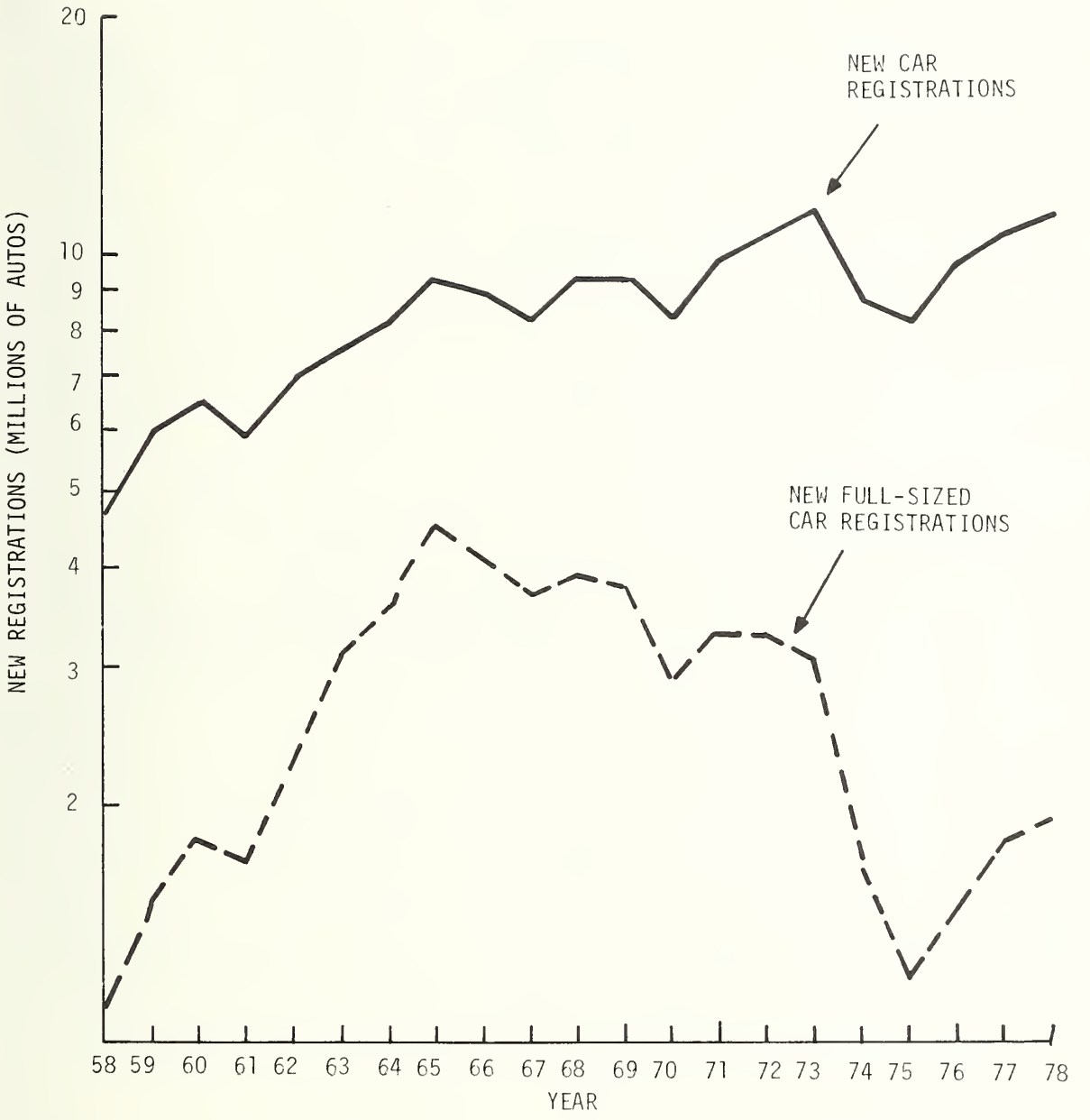
The demand for new motor vehicles has been cyclical since World War I.[10] Although the market has grown in these years from 1.5 million annually to over 9 million (U.S. factory sales), in 40 percent of the years, sales declined from the previous year Quite typically, sales advance for three years and then decline for two years. Even with the fluctuations in new motor vehicle sales, the registered motor vehicle fleet has grown steadily with the exception of a few years in the Great Depression and during World War II.

In the cyclical declines, typically, all types of motor vehicle sales decline. There are no true counter-cyclical types of motor vehicles, that is, motor vehicles for which sales rise while total industry sales decline and vice versa. However, in the recent sales recessions of 1969 to 1970 and 1974 to 1975, the domestic cars and especially the large domestic cars have experienced sharper sales declines than the rest of the market (see Figure 2-2). These cars are the cars that fleets and new car buyers tend to trade most frequently, thus, they are the easiest ones to hold on to for an extra year or two.

Since both the popular and trade press tend to focus their headlines on the domestic cars and, particularly, on the large and luxury domestic cars, there is a tendency to overstate the overall severity of the cyclical declines.

Over the past two decades, the industry has taken certain steps that tend to cushion the impact of the sales cycle.

a. Nearly all motor vehicle makes include a full line of cars. For instance, two decades ago, all Buicks were large cars; today, Buicks range from compacts to full-sized cars.



Source: Reference 11

FIGURE 2-2. TOTAL NEW AND FULL-SIZED NEW CAR REGISTRATION TRENDS

b. There are more multiple dealership franchises. Many domestic car dealerships have expanded their businesses to include import car franchises.

c. New car dealers increasingly emphasize their service capabilities. The workload in service departments tends to be counter-cyclical. The emphasis on dealer service is aided by the greater complexity of cars, implied warranties, and buyer protection plans.

2.3 THE SOCIO-ECONOMIC-POLITICAL ENVIRONMENT

The third factor which impacts the structure of the motor vehicle market is the socio-economic-political environment in which the market operates. Because of the size of the market and the importance of private transportation to all aspects of U.S. life, there are hardly any activities in the socio-economic-political environment which, in one form or another, are not affected by or do not affect the motor vehicle market. Therefore, this section has to be limited to those environmental conditions which have a major, unique, and direct impact on the market.

2.3.1 Gasoline

The market is sensitive to both the availability and the price of gasoline. If there is a fear of fuel shortages, the market tends to react violently. This happened both in the Winter of 1973-74 and in the Spring/Summer of 1979. In both cases there were major shifts from large to small cars. Both periods of shortages were accompanied by sharp rises in the price of gasoline; this also tends to shift the size class mix towards smaller cars.

Econometric models, such as the TSC/WEFA Model, project that each one percent increase in the price of gasoline increases the subcompact/compact share of the automobile market by .7 percent in the short term (i.e., the first year) and by .4 percent in the long term (i.e., ten years).[11] The Lave-Train model of automobile type choices estimates that with a 10 percent gas price

increase, the intermediate/full-sized share of the automobile market decreases by one-fourth.[12] These estimates are based on statistical evidence that is dominated by the 1973-74 gasoline price rises; they are estimates that appear reasonable for the class mix shifts in the Spring of 1978. However, since both times the extreme gasoline price increases were associated with fuel scarcities, it is an open question which of these two factors, price or scarcity, was most responsible for generating the market share shifts.

As long as the availability of gasoline has an immediate impact on the market, the question arises: What will be the long term impact on the market, if the perception of intermittant gasoline shortages persists for a number of years? It is quite possible that people under these circumstances will make major adjustments in their activity patterns and life style, which in turn, will impact their usage of motor vehicles and their demand for new motor vehicles.

2.3.2 Other Economic Impacts

The cyclical nature of the motor vehicle market is generally associated with the business cycle. Therefore, both short term and long term projections of the motor vehicle market trends tend to be based, at least in part, on the movements of general business indicators. Significant indicators are disposable income, savings, consumer debt, and unemployment. Motor vehicle demand varies directly with disposable income and savings, and varies indirectly with consumer debt and unemployment. The latter is usually included as a proxy variable for the confidence people have in the economy to make major capital purchases. Thus, if the unemployment rate is high or increasing, sales will be low or falling, even if unemployment is concentrated primarily among people who usually own no car, or buy only used motor vehicles.

2.3.3 Life Style

Many aspects of the current American life style depend on motor vehicle ownership by the vast majority of households.

Americans who lack cars or are unable to drive have great difficulties functioning in the American society. The person too poor to own a car often has great difficulty finding and holding a job, and is subject to extra expenses in obtaining goods and services. Persons too old to drive find themselves dependent on others for many of their basic needs.

Four uses of the motor vehicle appear primary to the American life style: recreation trips, goods movement and errand trips, work trips, and motor vehicle generated trips.[13] On the basis of NSF's 1978 National Transportation Survey[14] TSC estimates that recreational trips (including visiting friends and relatives) accounted for 23 percent of all trips, goods movements and errands for 43 percent, work trips for 23 percent, and vehicle generated trips for 11 percent. The four uses are discussed in the order in which they evolved historically.

Recreation: From the very beginning, cars were used for recreational travel. Originally much of this travel was satisfaction of the desire to move and to enjoy the vast increase in mobility which the motor vehicle afforded. Going for a Sunday drive was probably the most prevalent form of recreation in the America of the 1920's. and 1930's. In these decades, arterial traffic jams tended to be associated more with Sunday driving than with the rush hour.

Driving for recreation, to recreational facilities, and vacation driving is today a decreasing use of the motor vehicle, but an essential one for the survival of most establishments in the recreational and tourist industry. The boom in recreational vehicles during the late '60's and early '70's, in vans during the mid '70's, and in the 4-wheel drive utility vehicles during the late '70's, are all associated with the use of motor vehicles for recreation.

The carless must rely for their recreation/vacation travel on organized tours and common carrier travel, or spend their leisure time at home. Organized tours are becoming more popular even among those with cars. The tours range from bus charters to baseball and football games, to complete multi-week vacation packages. Also fly-and-drive vacations are gaining in popularity among the af-

fluent. Due to the increasing choice of alternatives to private motor vehicle travel, particularly among the affluent, the use of the car/truck in vacation travel may have already peaked in its popularity. This is suggested by the early data releases from the 1977 U.S. Census of Transportation.[15]

Goods Movement and Errands: The use of the motor vehicle for moving goods and running errands dates back nearly as far as its use for recreation. The usefulness of motor vehicles for shopping is a major reason that historically many families felt they could afford to buy a car and that many families today own a car. The reason that many people feel they need pickup trucks, vans, and large station wagons is at least as much associated with carrying goods as people. Also, many of the institutional and merchandising changes since World War II are directly associated with people's capability to haul goods in excess of what they can carry at one time in their arms. The mass merchandising at the supermarkets and shopping centers, in contrast to the neighborhood Pa and Ma food stores, is planned around people's capability to shop in quantity and to self-deliver their purchases.

People's capability to travel freely and easily in their own cars and to run their own errands has led to the abandonment of physician housecalls, regularly scheduled door-to-door delivery services, and a general centralizing of services to achieve greater economies of scale.

The carless perform these goods movement and errand trips either through friends or relatives who chauffeur them, or by taxi. Public transportation, outside of Manhattan, accounts only for a miniscule percentage of these trips.

With increased gasoline prices, people can be expected to reschedule these trips to reduce their frequency and, possibly, their distance, that is, they will shop less frequently and closer to home.

Work Trips: Although the extensive use of the motor vehicle for work trip travel occurred only after World War II, these trips today are a major factor in multi-motor vehicle ownership.

Already in the mid-1960s, Lansing and Hendrix showed that households with equal income were more likely to own two cars if they had two employed persons than if they had only one.[16] It is quite likely that the growth of the small car in the 1960s and 1970s can be associated with the growth in multi-worker households. Work trips usually involve very low car occupancy rates and usually do not involve the carrying of goods. Thus, the small car is far more suitable for this type of trip than for recreational travel and goods movement.

About 70 percent of all vehicular work trips are made by persons who drive alone. The rest are mainly by car pool, van pool, and transit.[17] To reduce road congestion, air pollution, parking requirements, and to conserve fuel, many attempts to increase car and van pooling have been made with varying degrees of success. In general, these programs are most successful among those with the longest commutes.

In brief, the American life style of decentralized residences and centralized retail, service, and employment centers requires motor vehicle ownership of most households for recreational/social and goods movement/errand trips, and often multi-vehicle ownership to accommodate work trips. The latter is particularly true if there are several workers in the household, or if the housekeeping function is performed on a part-time basis.

Motor Vehicle Generated Trips: The heavy reliance on trip making by privately owned motor vehicles also has the tendency to generate its own trips. Such trips include those to service stations and repair facilities, but more importantly they include all return trips home after discharging a passenger, and all trips made to pick up a passenger. One can also categorize these trips as the trips needed to station the car so that it can be used for transportation, or in the language of public transportation operators, the non-revenue mileage. Trip diary surveys have shown that up to 25 percent of all motor vehicle trips have at either trip end "to-serve-passenger" as their purpose.[18] Thus, over 10 percent of all motor vehicle trips (half of those to-serve-passenger trips) involve stationing the motor vehicle where it is

needed. It is well known that parents spend a great deal of time chauffeuring their children. However, with increased motor vehicle ownership per household and fewer children (non-drivers) per household, it is possible that the motor vehicle generated trips have peaked.

2.3.4 Demographics:

Motor vehicle ownership and the type of motor vehicle people buy are in part of function of personal circumstances. Thus, income, sex, age, marital status, household size, and area of residence are factors which influence automobile ownership. These factors are considered to be sufficiently stable that they can be used in mathematical modeling as parameters for projecting motor vehicle sales. Therefore, a shift between 1979 and 1985 in household real income or in the population's age distribution is expected to be reflected both in the size of the market and the market mix.

There is no doubt that the motor vehicle market, both in its size and mix, will be affected during the coming decade by a shift in the U.S. age structure. The so-called post-war "baby boom" generation (persons born between 1947 and 1961) is aging, and starting in 1978, there were fewer individuals in the 16 year old age group. This age group will continue to decrease in numbers nearly every year for the next ten years, before it levels off at about 70 percent of its 1978 size in the early and mid 1990's.[19]

The adult age structure can be projected fairly accurately. The projection of other demographic variables which are of importance to the market are much more difficult to project. Will the age at first marriage continue to rise? Will the percent and number of two-worker households increase? Will there be more or fewer one, two, three, four, five, etc. member households?

In general, demographic projections (as well as trend line projections) lead to a continued rise in the motor vehicle fleet and in new motor vehicle purchases. However, it is quite possible that the public's adjustment to intermittant gasoline lines may considerably overshadow any demographic impact on the market.

3. MOTOR VEHICLE TRENDS

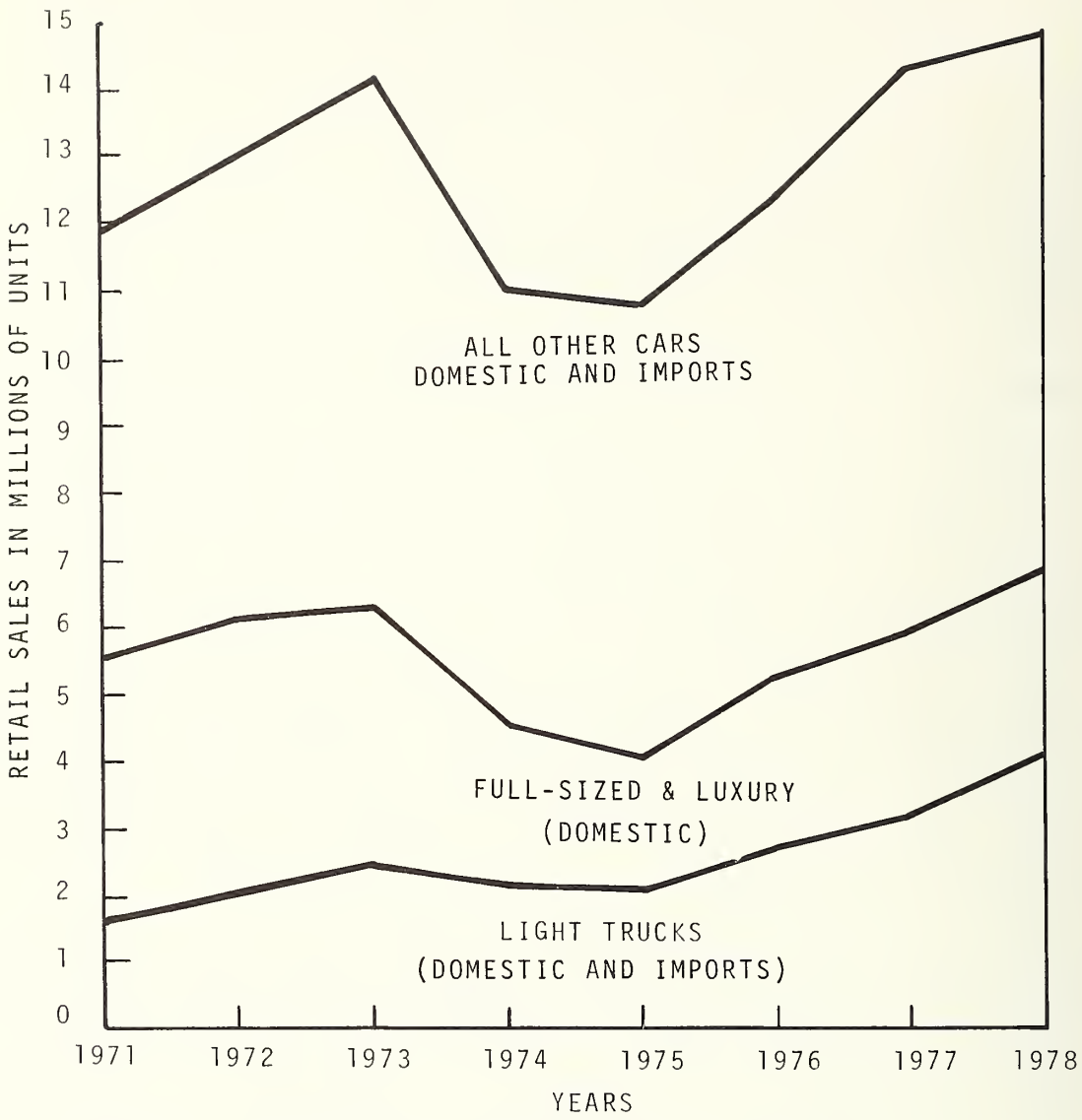
This section discusses the major trends in motor vehicle sales, sales mix, scrappage, registration, and vehicle miles traveled as they occurred during the 1970's.

3.1 TOTAL MOTOR VEHICLE SALES

Total motor vehicle sales increased between 1971 and 1978 from about 12 million to 15 million vehicles per year (see Figure 3-1). Total motor vehicle sales include both domestic and imported passenger cars and light trucks. Light trucks are all vehicles which are not passenger cars and which have a gross vehicle weight of less than 10,000 pounds. The annual growth of total motor vehicle sales was 3.1 percent, which is approximately the same growth rate in motor vehicle sales that prevailed during the 1960's.

Total motor vehicle sales in the 1970's showed the same cyclical patterns as in previous decades. There was a decline in sales in 1968-70 and again in 1974-75. Total 1979 sales were less than 1978 sales, as one could expect from past experience with the motor vehicle sales cycles.

The 3.1 percent annual growth of motor vehicle sales was accompanied by a 4 percent annual growth in the registered fleet (see Section 3.3) and outpaced the growth in any of the major demographic variables, such as growth in population (.9 percent annually), population of driving age (1.8 percent), household formation (2.3 percent), and per capita disposable personal income in constant dollars (2.5 percent)[20]. The trend for the motor vehicle fleet, both new vehicles and total registrations, to outperform the major demographic variables continued in the 1970s, as it had since 1946. The American life style of the 1970s thus continued to adapt itself to the greater use of private motor vehicle transportation. The Arab Oil Embargo of 1973-74 did not impact this long term trend in motor vehicle ownership.



Source: TSC ANALYSIS OF MVMA AND WARD'S DATA

FIGURE 3-1. NEW MOTOR VEHICLE SALES, BY YEAR

3.2 TRENDS IN MOTOR VEHICLE SALES MIX

During the 1970s there were major changes in the sales mix of the motor vehicles sold. In general, the large passenger cars and station wagons lost sales, and the light trucks, vans, and utility vehicles gained sales. (see Tables 3-1 and 3-2.)

3.2.1 Full-Sized Cars and Station Wagons

Between 1971 and 1978 the market share of full-sized cars in the total motor vehicle market dropped from nearly 30 percent to a shade over 14 percent. Two-thirds of this decline benefitted the light trucks and the remainder the compact and subcompact cars.

The decline in the market shares of full-sized cars began in 1972 and gained momentum in 1973. By 1975, the market shares had dropped to 14 percent. There was a minor (2 percentage points) recovery in 1976 and 1977, but by 1978 the market shares fell again to the 14 percent level. In the Spring of 1979, with the recurrence of gasoline lines, the market shares were at 11 percent (May 1979).[21] It is well known that gasoline lines are detrimental to full-sized car sales, but they are not the only reason for this decline. The 1972-73 decline antedates the Arab Oil Embargo and any major public perception of coming gasoline shortages and higher gasoline prices. Also, the 1978 decline antedates the Iranian Revolution. The decline in full-sized cars may be connected with the decline of large households. Households with four or more persons accounted for 37 percent of all households in 1970 and only 31 percent of all households in 1977. The absolute number of these households, however, remained constant at 23.1 million[22]. In addition, the increased number of households which own two or more vehicles may have contributed to this decline (see Section 4.3.1).

The sales of large sized station wagons declined at an even greater rate than that of the full-sized cars (a category which includes the large sized station wagons). Station wagon market

TABLE 3-1. RETAIL SALES SUMMARY BY INDUSTRY CLASSIFICATION, BY YEAR

	1971	1972	1973	1974	1975	1976	1977	1978
Imports (Includes Captives)	1,563,178	1,613,706	1,748,061	1,399,081	1,571,472	1,498,753	2,074,390	1,999,915
Domestic Cars								
Subcompacts	759,553	893,522	1,072,440	1,082,091	1,086,018	999,565	952,905	1,210,165
Compact	1,585,992	1,603,134	1,990,079	1,782,508	1,844,604	2,316,798	2,226,497	2,223,101
Intermediate	2,393,145	2,726,499	2,851,217	2,162,093	2,058,059	2,706,213	2,959,646	3,007,772
Full-Sized	3,533,417	3,612,691	3,400,054	1,977,135	1,547,286	1,999,515	2,272,819	2,141,264
Luxury	374,590	411,117	449,949	352,723	409,067	468,161	559,638	581,547
Passenger Vans	62,148	74,519	86,703	92,189	105,086	119,519	137,517	
Totals (Domestic)	8,708,845	9,321,482	9,850,442	7,448,739	7,050,120	8,609,771	9,109,022	9,311,666
Total Passenger Cars (Domestic and Imports)	10,272,023	10,935,188	11,598,503	8,847,820	8,621,592	10,108,524	11,183,412	11,311,581
Light Trucks								
0-6000 lbs								
Utility				157,014	65,156	60,968	68,674	79,588
Car Type Pickup				75,288	53,534	66,667	76,997	83,522
Compact Imported Pickup				175,497	228,097	236,211	321,364	334,918
Van & Cutaway Chassis				205,429	178,943	185,340	117,354	126,072
Conventional Pickup				893,452	693,588	904,287	909,016	904,002
Station Wagon (Truck Chassis)				48,913	4,454	438	23	-
Passenger Carriers				2,263	371	582	429	472
Multistop				2,229	93	5	-	-
Other				7,179	2,950	8	4	-
Total 0-6000 Lbs	1,184,741	1,497,630	1,754,254	1,567,264	1,227,186	1,454,506	1,493,861	1,528,574
6001-10,000 Lbs								
Utility				2,668	92,825	152,366	183,345	275,790
Vans				} 117,133	} 199,416	} 337,475	380,641	471,334
Van Cutaway							77,978	76,277
Conventional Pickup				469,195	540,580	799,564	1,032,190	1,171,257
Station Wagon (Truck Chassis)				15,487	50,128	72,832	87,764	100,395
Passenger Carriers				1,243	3,228	4,746	5,632	6,398
Multistop				27,581	25,469	33,517	35,142	38,193
Other				62,941	40,064	447	-	-
Total 6001-10,000 Lbs	487,633	598,813	758,236	696,248	951,710	1,400,947	1,802,692	2,139,644
Total Light Trucks	1,672,374	2,096,443	2,512,490	2,263,512	2,178,896	2,855,462	3,296,553	3,668,218
Total Motor Vehicles	11,944,397	13,031,631	14,110,993	11,111,332	10,800,488	12,963,977	14,479,965	14,979,799

TABLE 3-2. MARKET SEGMENTS, BY YEAR (%)

	1971	1972	1973	1974	1975	1976	1977	1978
IMPORT CARS	13.1	12.4	12.4	12.6	14.6	11.6	14.3	13.4
DOMESTIC CARS								
Subcompact	6.4	6.9	7.6	9.7	10.1	7.7	6.6	8.1
Compact	13.3	12.3	14.1	16.0	17.1	17.9	15.4	14.8
Intermediate	20.0	20.9	20.2	19.5	19.0	20.9	20.4	20.1
Full-Sized	29.6	27.2	24.1	17.8	14.3	15.4	15.7	14.3
Luxury	3.1	3.2	3.2	3.2	3.8	3.6	3.9	3.9
Passenger Vans	0.5	0.6	0.6	0.8	1.0	1.0	0.9	1.0
DOMESTIC TOTALS	72.9	71.5	69.8	67.0	65.3	66.4	62.9	62.2
TOTAL PASSENGER CARS (DOMESTIC AND IMPORTS)	86.0%	83.9%	82.2%	79.6%	79.8%	78.0%	77.2%	75.5%
LIGHT TRUCKS (0-10000 Lbs)								
Imported	0.8*	1.1*	1.6*	1.6	2.1	1.8	2.2	2.2
Conventional & Cartype Pickup	9.6*	10.4*	11.6*	12.9	11.9	13.7	13.9	14.4
Vans and Multistors	2.1*	2.8*	2.7*	3.2	3.7	4.3	4.2	4.8
Utilities	1.1*	1.2*	1.3*	1.4	1.5	1.6	1.7	2.4
Station Wagons (Truck Chassis)	0.5*	0.5*	0.7*	0.6	0.5	0.6	0.6	0.7
TOTAL LIGHT TRUCKS	14.1%	16.0%	17.9%	20.4%	20.2%	22.0%	22.0%	24.5%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*Market segment shares based on factory sales and are therefore estimates of retail sales market segments. All other market segment shares are based on retail sales.

Sources: References 1, 2, 3, 4

shares declined from 4.7 percent in 1971 to 1.9 percent in 1975, recovered in 1976 and 1977, and declined again in 1978 (see Table 3-3). These two declines in market share antedate the respective fuel shortages of 1973-74 and 1979. Apparently, about 60 percent of the decline in large sized station wagons was diverted to medium sized station wagons. The remainder probably went to the growing light truck market.

3.2.2 Light Trucks

Light trucks increased their market share from 14 percent in 1971 to 24 percent in 1978. The growth was rather steady during this period. In only one year, 1975, was there a minor decline. 1978 was a peak year for light trucks, since their market share declined in 1979 to 22 percent.

Between 1971 and 1978, the market share of pickups increased by 50 percent, of utility vehicles by 100 percent, of vans by 120 percent, and of the small imported pickups by 175 percent. With the decline in truck sales in 1979, pickups, utilities, and vans lost market shares, but the small imported pickups increased their share from 2.2 percent to 3.4 percent of the total motor vehicle market (January through May 1979).

The market share growth by truck body style has also been quite steady during this period. The one exception is the pickups which lost shares in 1975, though not in 1974, and the small imported pickups which spurted in their market share in 1975 and in 1979.

Apart from the energy crisis and the downsizing of large cars, there are some indications that truck sales in some markets may be reaching their saturation. For instance, between 1970 and 1977, according to University of Michigan data[23], truck ownership actually dropped among those occupational groups most closely associated with truck ownership, that is, farmers and self-employed business persons, and showed no growth, or growth well within the sampling error, for operatives, labor, and service employees. Growth was concentrated among families headed by professionals, managers,

TABLE 3-3. ESTIMATED MARKET SHARES OF MEDIUM AND LARGE STATION WAGONS (Percent of Total Motor Vehicle Market)

STATION WAGONS			
Calendar Year	Medium	Large	Total
1971	2.0	4.7	6.7
1972	2.2	4.6	6.8
1973	2.1	3.9	6.0
1974	1.7	2.5	4.2
1975	1.7	1.9	3.6
1976	3.1	2.4	5.5
1977	3.4	2.7	6.1
1978	3.5	2.1	5.6

Source: PART II, Table 8-2 adjusted for total motor vehicle sales.

clericals, craftsmen, and foremen.

The increase in demand for light trucks during the 1970's seems to reflect the desire for a more spacious vehicle. This conclusion follows if one postulates a simple vehicle type shift, namely that these trucks are bought by persons who in the 1960's market bought full-sized sedans or large station wagons. Since the trend well antedates any federal emission or fuel economy regulations, these regulations cannot have been the impetus to this shift. However, if one analyzes the type of truck people bought at various times, emission regulations appear to be a major factor in the selection.

The steady growth in total light truck sales is contrasted by the dramatic growth in the Class II (over 6,000 pounds gross vehicle weight) light truck sales in Model Years 1975 through 1978. During these four years, these vehicles were exempted from EPA emission standards, and thus did not have catalysts or use unleaded gas.

Before the EPA requirements were mandated, prior to the 1975 Model Year, the share of new light trucks registered as Class II (the percent of all light trucks 0 - 10,000 pounds GVW that were between 6,001 and 10,000 pounds GVW) was consistently between 29 percent and 32 percent. The Class II share of light trucks jumped over 10 percentage points between 1974 and 1975 and increased to 55 percent by 1977 (see Table 3-4). The upsizing of light truck purchases which occurred in response to EPA emissions control standards on Class I vehicles indicates that many buyers bought the larger trucks to avoid the catalytic converter and the higher priced unleaded fuels.

Recent data indicate that the upsizing of light truck purchases that began in 1975 is subsiding, since EPA emissions standards for Model Year 1979 were extended to vehicles up to 8,499 pounds GVW. Class II shares of light truck sales grew steadily through January-August 1979 to a high of 59 percent, but began to fall to 53 percent by January-April 1979 after the

TABLE 3-4. CLASS II (6,001 - 10,000 lbs., GVW) MARKET SHARES

MY	Percent of Light Truck Sales	Percent of Total MV Sales
1971	29.2	4.1
1972	28.6	4.6
1973	30.2	5.4
1974	30.7	6.3
1975	43.7	8.8
1976	49.1	10.8
1977	54.7	12.4
1978 (Jan - Aug)	59.0	14.5
1978 (Sept - Dec)	56.7	13.8
1979 (Jan - Apr)	52.9	12.4

Source: a. 1971-77 data: Part II, Section 1

b. January 1978-April 1979 data: TSC Motor Vehicle Sales and Price Memorandum, monthly, January 1978 - April 1979.

emissions controls were added to the bulk of Class II trucks.

3.2.3 Fuel Efficient Vehicles

This section briefly summarizes the market performance of some of the vehicles that were produced to improve fuel efficiency. Table 3-5 is a summary of the sales performance of the downsized cars.

a. GM Full-Sized Cars: GM downsized their full-sized cars beginning with Model Year 1977. These cars were a startling success in the market. Within their size class, GM gained market share, both with Model Year 1977 when the market was growing and size class sales were expanding and in 1978 when the size class contracted in a market with modest growth. In the 1979 market when the size class shares were declining, GM managed to protect its size class market share.

b. Ford Full-Sized Cars: Ford downsized its full-sized cars with Model Year 1979. With the shrinking market for full-sized cars in this model year, Ford's downsized cars were not a market success. For the third year in a row, Ford lost market share.

c. GM Intermediates: GM downsized their intermediates with Model Year 1978. Since then, GM intermediates have gained market share within their size class, but have lost market share in the total motor vehicle market. Their sales record is mixed.

d. GM Diesels: GM introduced diesel engines on their full-sized Oldsmobiles in late 1977, and on Cadillacs in 1978. The demand for these vehicles has always outstripped their supply, which is quite limited. GM's diesel deliveries in early 1979 were at a rate of 135,000 vehicles per year.

e. Chrysler Subcompacts: In January 1978, Chrysler entered the domestic car subcompact market with the Dodge Omni and the Plymouth Horizon. These newly designed cars were well received in the market until the July 1978 issue of Consumer Reports[24] questioned their steering and control capabilities. This resulted in a 20-30 percent sales drop for the remainder of the year. With the Iranian Revolution, sales spurted, the backlog was cleared,

TABLE 3-5. MARKET SHARES OF FORD AND GM CARS BEFORE AND AFTER DOWNSIZING*

Vehicles:	Share of Size Class (%) Ford	GM	Share of Total Market (%) Ford	GM	Size Class Share (%) of Total Market (%)
Full-Sized					
1976 (Jan-Sept)	27.8	63.6	4.8	10.9	17.1
1977 (Jan-Sept)	25.1	67.9**	4.9	13.1**	19.3
1978 (Jan-Sept)	24.3	72.8**	4.3	12.8**	17.6
1979 (Jan-May)	22.1**	72.6**	3.6**	11.9**	16.3
Intermediates					
1976 (Jan-Sept)		67.3		14.7	21.9
1977 (Jan-Sept)		60.5		12.7	20.9
1978 (Jan-Sept)		62.5**		12.6**	20.2
1979 (Jan-May)		74.9**		12.2**	16.3

*Table is based on January through September retail sales deliveries to represent model year. October through December data are omitted since they include sizeable proportions of cars from each of two model years.

**Downsized vehicles.

Source: TSC Motor Vehicle Sales and Price Memorandum, for September 1977, 1978 and May 1979.

and by April/May 1979, the Omni Horizon deliveries were supply limited.

The mixed sales record of the downsized cars emphasizes the complexity of the market. To some buyers downsizing is not acceptable. These buyers may have switched from full-sized GMs to Fords in MY 1977 and 1978, while others who wanted downsized cars may have switched from Ford to GM. When Ford downsized, the buyer insisting on non-downsized cars may have left the market temporarily while those accepting downsizing may have opted for the more established downsized car, i.e., the GM car which was in its third model year.

3.3 MOTOR VEHICLE SCRAPPAGE TRENDS

Like sales, motor vehicle scrappage is cyclical, and shows considerable variation from year to year. The total number of motor vehicles retired from use each year is shown in Table 3-6. The total scrappage for any one year is a function of the size of the registered fleet, the age composition of the registered fleet, and the proclivity to scrap. The latter is a function of the business cycle.

To measure this proclivity to scrap at any one time, TSC developed a technique for estimating "expected vehicle life" (see Part II, Section 2). Technically, the expected vehicle life in year i is defined as the average number of years members of a class of vehicles remain in the fleet, if members of the class are scrapped at each vehicle age at the same rate class members, by vehicle age, were scrapped during year i. The expected vehicle life is thus not the expected life of a model year, but a measure of the conditions that prevailed during a period of calendar time. In the language of demographics, TSC measured the average life expectancy of stationary vehicle populations.

The "expected vehicle life" for cars and trucks during recent years is shown in Table 3-7. The "truck data" include all trucks and buses regardless of vehicle weight. However, since about 85% of these vehicles are light trucks, the behavior of light trucks dominates these statistics. Trucks have a life expectancy which

TABLE 3-6. MOTOR VEHICLES RETIRED FROM USE (IN THOUSANDS)

YEAR ENDING JUNE 30	PASSENGER CARS	TRUCKS	TOTAL
1978	7907	1426	9333
1977	8234	1668	9902
1976	6829	1097	7926
1975	5669	908	6576
1974	7194	1047	8241
1973	7987	1208	9195
1972	7058	1048	8106
1971	6021	1044	7065
1970	7461	837	8298
1969	6348	966	7314
1968	6200	861	7061
1967	6984	947	7931

Source: R.L. Polk & Co.

TABLE 3-7. EXPECTED VEHICLE LIFE FOR CARS AND TRUCKS

YEAR ENDING JUNE 30	CARS		TRUCKS	
	VEHICLE LIFE	CHANGES IN VEHICLE LIFE	VEHICLE LIFE	CHANGES IN VEHICLE LIFE
77-78	10.3	+ .5	13.7	+ .6
76-77	9.8	- .5	13.1	-1.8
75-76	10.3	- .6	14.9	- .7
74-75	10.9	+1.1	15.6	+1.3
73-74	9.8	+ .7	14.3	+ .1
72-73	9.1	- .3	14.2	+ .7
71-72	9.4	- .4	13.5	- .3
70-71	9.8	+ .9	13.8	- .1
69-70	8.9		13.9	

Source: TSC Analyses of R.L. Polk & Co. Registration Data

is 3 to 5 years greater than cars. TSC has performed some limited analyses to associate automobile body style and engine size with expected vehicle life. To date these limited analyses have produced no definitive results.

From 1969 to 1978 the trend in automobile life expectancy has been generally upward. The trend peaked during 1974-75, that is during the recession that followed the Arab Oil Embargo. The decline in automobile life expectancy during 1975-77 was relatively minor and was followed in 1977-78 by a rise in life expectancy. More detailed analyses (see Part II, Sections 2 and 5) also show that for 6 to 11 year old cars the scrappage rate has been substantially lower in the late 1970s than in the early 1970s. This means that people are holding on to their cars in this age range to a greater extent than in the past.

There was an upward trend in truck life expectancy between 1969 and 1975. Subsequent to the 1973-74 fuel shortage, truck life expectancy peaked. Following the peak, there was a rapid decline in truck life expectancy to levels below those early in the decade. The sharp drop in truck life expectancy and only moderate recovery in 1977-78 are probably associated with the changes that are occurring in the truck market as it is moving from a market dominated by commercial transportation to a market dominated by personal transportation.

3.4 MOTOR VEHICLE REGISTRATION TRENDS

During the 1970s, the motor vehicle fleet grew at a very steady rate with only minor fluctuations (Table 3-8). The total fleet grew at an annual rate of about 4 percent. The truck fleet increased at a rate of about 7 percent and the automobile fleet increased at a rate of 3 percent. Though these growth rates fluctuate from year to year, the fluctuations are relatively minor. With rising new motor vehicle sales, the scrappage rate tends to increase, and with falling sales, the scrappage rate declines. This relationship between new motor vehicle sales and scrappage tends to smooth the growth rate of the registered fleet.

TABLE 3-8. MOTOR VEHICLES IN OPERATION

YEAR	CARS (IN MILLIONS)	% GROWTH	TRUCKS (IN MILLIONS)	% GROWTH	TOTAL (IN MILLIONS)	% GROWTH
1965	68.9	4.3	13.1	5.6	82.0	4.6
1966	71.3	3.5	14.4	9.9	85.7	4.5
1967	73.0	2.3	15.0	4.1	88.0	2.6
1968	75.4	3.3	15.7	4.1	91.1	3.5
1969	78.5	4.1	16.6	4.6	95.1	4.3
1970	80.4	2.4	17.7	5.7	98.1	3.1
1971	83.1	3.4	18.5	6.6	101.6	3.5
1972	86.4	4.0	19.8	4.5	106.2	4.5
1973	89.8	4.0	21.4	7.0	110.2	3.7
1974	92.6	3.1	23.3	8.0	115.9	5.1
1975	95.2	2.8	24.8	8.8	120.0	3.5
1976	97.8	2.7	26.6	6.4	124.4	3.6
1977	99.9	2.1	28.2	7.2	128.1	2.9
1978	103.0	3.1	30.5	6.0	133.5	4.2

Note: Trucks includes all trucks and buses. TSC estimates that over 85% of all registered trucks and buses are light trucks.

Source: R.L. Polk and Company

The persistency of the growth in the registered fleet at rates that exceed the major demographic parameters indicates, as already noted above, that the life style and activity pattern trends still include increased motor vehicle ownership.

3.5 TRENDS IN VEHICLE MILES TRAVELED

The number of miles vehicles travel in a period of time is a fundamental parameter for any study of fuel consumption. On a disaggregated basis, as for instance one's own motor vehicle, one can determine the vehicle miles traveled (VMT) by reading the odometer at the beginning and end of a given time period. On a more aggregated basis, i.e., to obtain national and state estimates of VMT for a month or a year, such direct measurements are usually not feasible.

To obtain ongoing estimates of VMT as it changes from month to month or year to year, two types of indirect measures are used.

a. Traffic Counts: One counts the traffic on selected road segments and then estimates from these the aggregate traffic on all road segments. The VMT is then the product of the traffic counts times the mileage in the road segments. The quality of these estimates is a function of the quality of the sample design through which the road segments were selected.

b. Fuel Consumption: One measures total fuel consumption and assumes a fleet mpg average. The quality of these estimates is directly proportional to the quality of the fleet mpg average, where mpgs must be weighted by the relative amount of VMT which each type and age of vehicle generates.

In short, our ability to measure VMT in absolute terms is quite poor, but our ability to determine relative increases and decreases in VMT from time period to time period is probably quite reliable.

3.5.1 Aggregate VMT

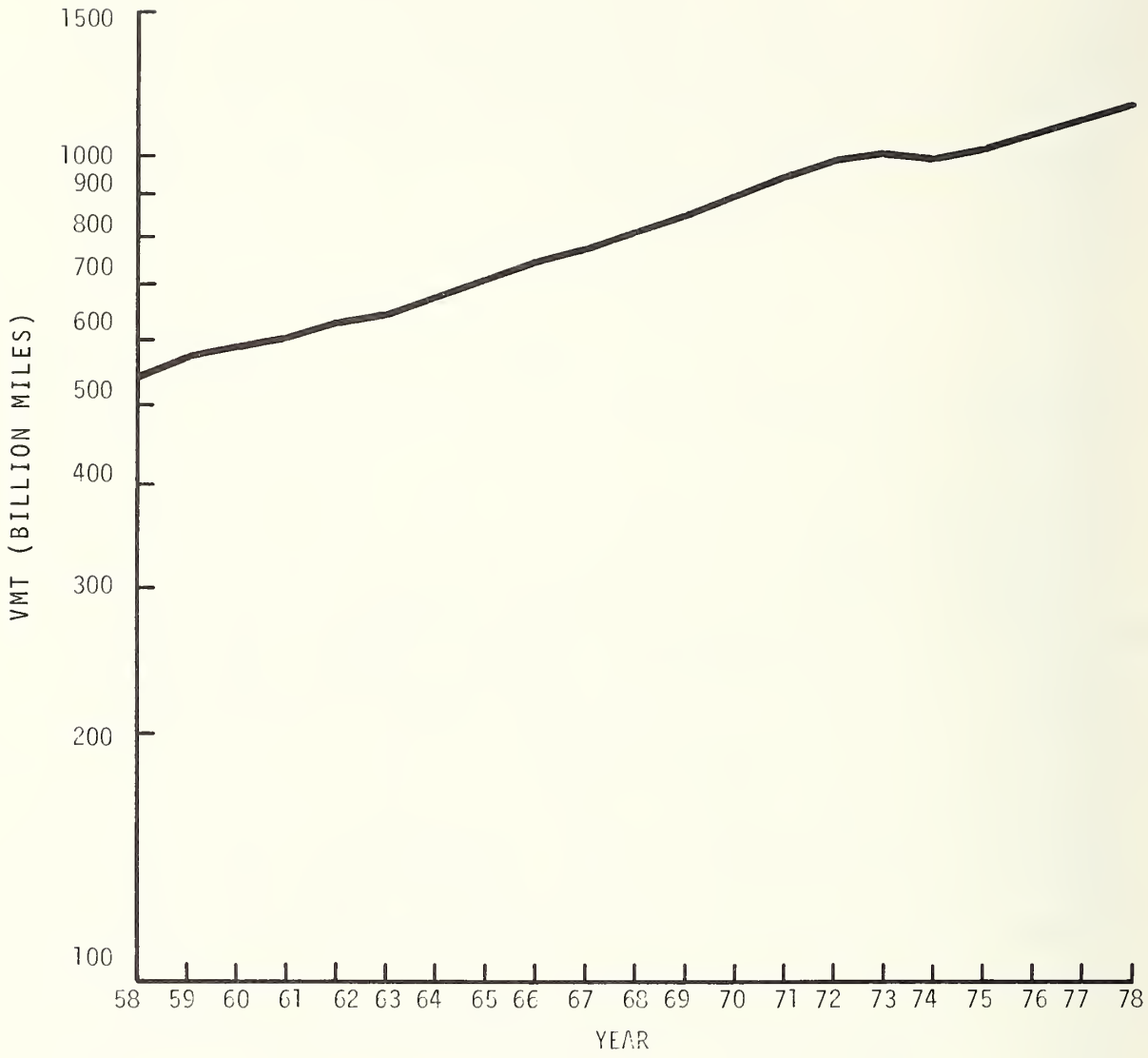
Figure 3-2 shows the growth in VMT over the past two decades as estimated by the Federal Highway Administration. These data are compiled from state estimates which use both types of indirect measures. Table 3-9 contains the same data in tabular form. These data show that the growth in VMT on a percentage basis steadily increased during the 1960's, when most of the Interstate Highway Mileage was opened, and reached its peak of about five percent in the years before the Arab Oil Embargo. In 1974, VMT declined, and since then, the growth rate has been at a lower rate than in the 1968-72 period.

From these aggregate data it appears that the general growth in VMT was apparently permanently affected by the 1973-74 gasoline lines and price increases.

3.5.2 Disaggregate VMT

The number of miles a vehicle is driven in a given year is strongly related to the age of the vehicle. Older vehicles are driven less. Figure 3-3 shows the relationship between annual vehicle mileage and vehicle age according to the 1978 NSF-sponsored National Transportation Survey.[25]

The type of vehicle people drive may also be a factor in the miles the vehicle is driven. This is suggested by the data obtained from Market Facts' Consumer Mail Panel.[26] These data suggest that among newer cars (up to 6 years old) the number of miles driven is directly proportional to the size of the car, but that in older cars the relationship is indirect. TSC is analyzing some recent data bases to test these hypotheses.



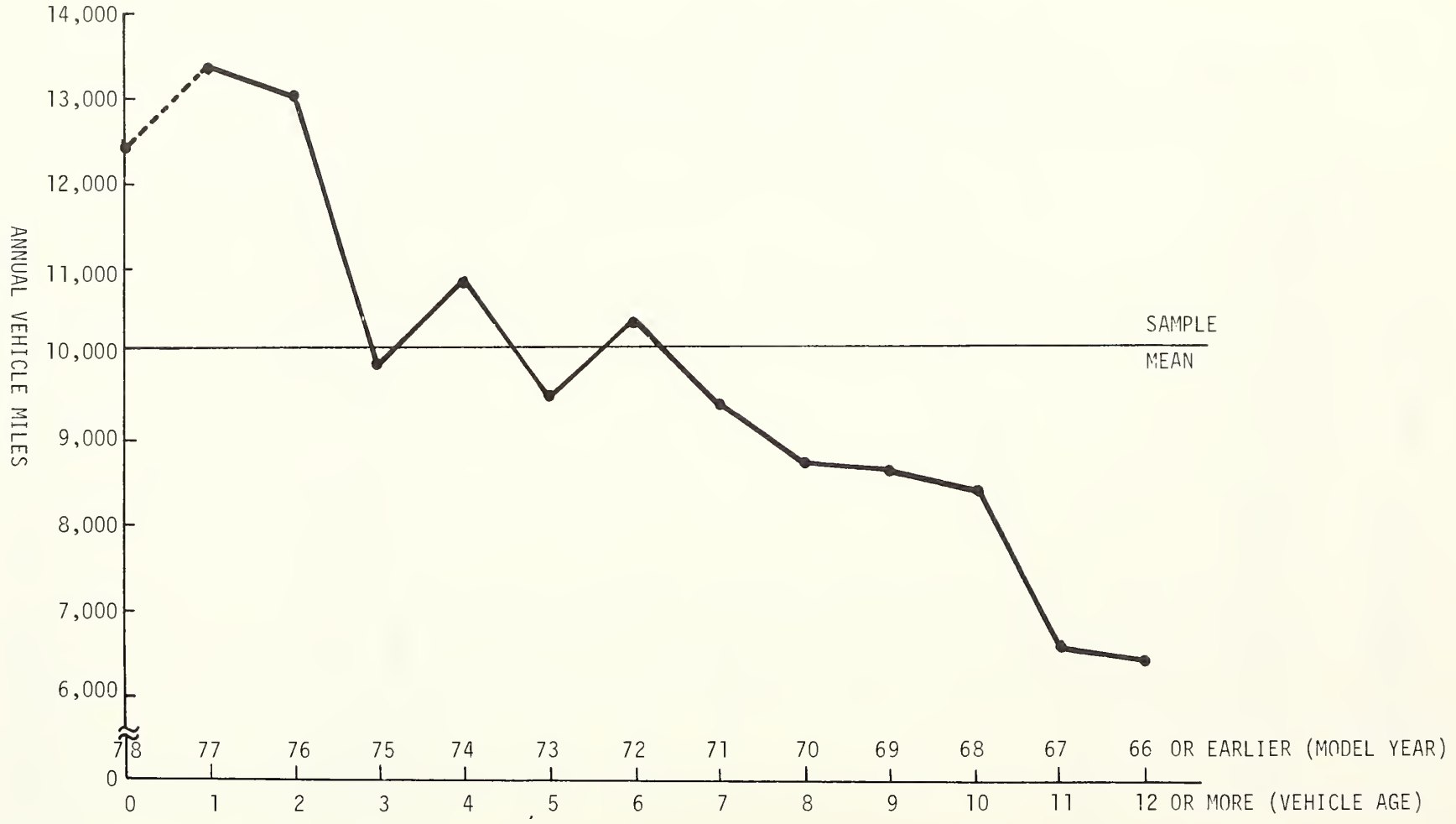
Source: Federal Highway Administration, Highway Statistics, 1958-78.

FIGURE 3-2. TRENDS IN VEHICLE MILES TRAVELED (VMT) OF PASSENGER CARS

TABLE 3-9. TRENDS IN VEHICLE MILES TRAVELED (VMT) OF PASSENGER CARS

Year	VMT (BILLION MILES)	% CHANGE FROM PREVIOUS YEAR
1958	542.16	-
1959	570.13	5.2
1960	585.16	2.6
1961	601.55	2.8
1962	625.97	4.1
1963	642.16	2.6
1964	674.24	5.0
1965	706.39	4.8
1966	744.84	5.4
1967	766.47	2.9
1968	805.69	5.1
1969	849.63	5.5
1970	890.84	4.9
1971	939.10	5.4
1972	986.41	5.0
1973	1016.86	3.1
1974	990.72	-2.6
1975	1028.12	3.8
1976	1075.76	4.6
1977	1118.65	4.0
1978 (Preliminary)	1160.00	3.6

Source: Federal Highway Administration, Highway Statistics, 1958-78.



Source: Reference 25.

FIGURE 3-3. 1978 ANNUAL VEHICLE MILEAGE BY VEHICLE AGE

4. CONSUMER TRENDS

This section discusses some of the major trends in consumer behavior and attitudes with respect to motor vehicle ownership, choice of motor vehicle, fuel efficiency of motor vehicles, and expenditures on motor vehicles.

4.1 MOTOR VEHICLE OWNERSHIP

Motor vehicle ownership on a per household basis increased during the 1970s (see Table 4-1 and Figure 4-1). The percent of households that owned no motor vehicle declined only slightly during this period, thus, the increase was primarily due to an increase in households that own two, three, or even more vehicles. This growth occurred in the face of the decline of the average population per household, and the average number of adults (18 years and over) per household. Therefore, the number and percent of adults who have a motor vehicle at their disposal increased sharply during the 1970s. Since median household income (in constant dollars) remained stable and mean income increased by only 3 percent between 1970 and 1977, most of the 7 percent to 16 percent rise in motor vehicle ownership is due to changes in activity patterns rather than income.[27] The sharp rise in paid employment among married women under 45 years of age is probably one change in activity patterns that generated the rise in motor vehicle ownership.[28] Traditionally, families with equal income but with two workers are more likely to own two motor vehicles than those with only one worker.[16] In addition, a recent study showed that the number of workers in a household exhibits a constant marginal effect on motor vehicle ownership level, whereas other measures of household size and household income exhibit only a marginally decreasing effect on motor vehicle ownership.[29]

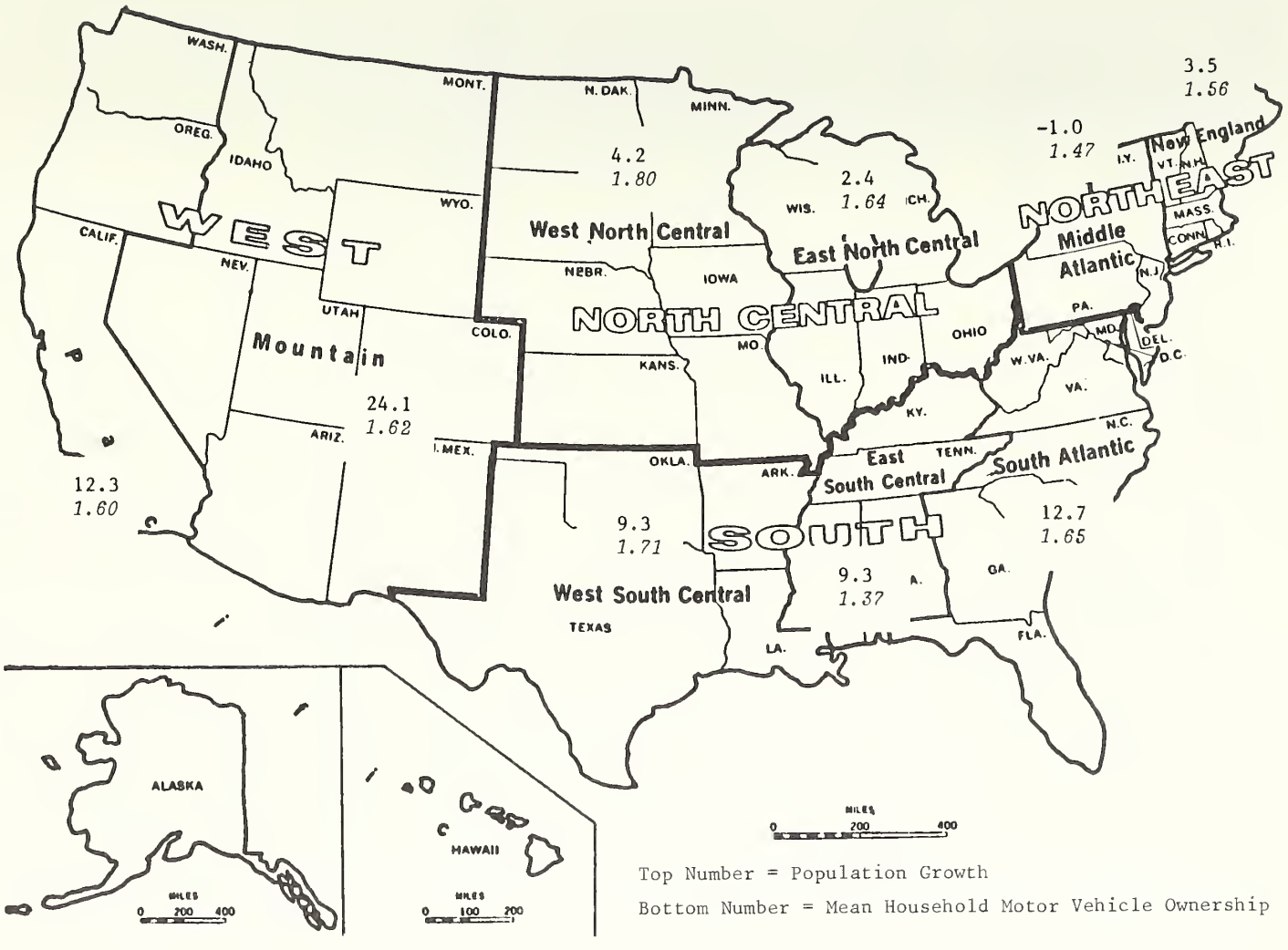
Internal migration of the U.S. population is a factor frequently mentioned as a cause of growth in motor vehicle ownership. It is said that people are moving to areas with high motor vehicle ownership and are leaving areas with low vehicle ownership. Though

TABLE 4-1. MOTOR VEHICLES PER HOUSEHOLD

	1970[a]	1975[b]	1976[b]	1977[a]	1978[c]
Cars	1.15	1.18	1.18	1.20	N/A
Trucks	.23	.21	.22	.28	N/A
Total Motor Vehicles	1.38	1.39	1.40	1.48	1.61
Households with no Motor Vehicles	18%	15%(*)	15%(*)	17%	14%
Average Population Per Household[d]	3.14	2.94	2.89	2.86	2.81
18 and over Population	2.05	2.01	2.00	1.99	1.98

(*) Households without cars, some of these households may own trucks.

Sources:
a. University of Michigan, Survey of Consumer Finances, 1970, 1977.
b. U.S. Annual Housing Survey, 1975, 1976.
c. NSF/National Transportation Survey, 1978. The survey lists only total ownership by household.
d. U.S. Census, Current Population Report. P-20, No. 327, August 1978.



Source: U.S. Census Current Population Report, P-25-79D, Dec. 1978
CS1/WI Motor Vehicle Assessment, Vol. 1, Table 5-4.

FIGURE 4-1. POPULATION GROWTH (1970-1978) AND MEAN HOUSEHOLD MOTOR VEHICLE OWNERSHIP (1978) BY CENSUS DIVISION

this is correct, multicar motor vehicle ownership in the 1970s was growing fastest where it was weakest. For instance, University of Michigan data show that multi-vehicle ownership in the central cities of the twelve largest metropolitan areas grew from 17 percent in 1970 to 34 percent by 1977.[23] Meanwhile in the suburban areas, where traditionally more households own two or more vehicles, the growth was only from 34 percent to 47 percent. These growth patterns have tended to stabilize motor vehicle ownership throughout the nation. As Table 4-2 and Figure 4-1 indicate, the Census divisions with the fastest population growth have about the same motor vehicle ownership rates as the nation as a whole.

One of the strongest negative correlations to household motor vehicle ownership is distance to transit stops. The closer people live to a bus stop, the lower a household's motor vehicle ownership will be.[30] This is a firmer correlation than distance from city center or regional differences. The correlation between motor vehicle ownership and distance to a transit stop is far more pronounced than one would assume from transit/motor vehicle mode split patterns. The relationship may thus be more one of covariance than causation. Still, one must at least allow for the possibility of causation. From this point of view, the extension of transit coverage fostered by the federal transit operating subsidies authorized in 1974, together with the steady growth in transit ridership since 1977, indicate an activity pattern change that should exert negative pressures on the per household growth of motor vehicle ownership.[31]

4.2 MOTOR VEHICLE CHOICES

Ever since Sloan formulated his famous dictum, "A car for every purse and purpose," and perhaps even earlier, researchers have tried to determine the desires of the different purses and purposes. There is little question that certain types of vehicles find their markets among certain types of persons. Thus, a women is more likely the principal driver of a new sporty coupe than of any other type of car.[32]

TABLE 4-2. POPULATION GROWTH AND MEAN HOUSEHOLD MOTOR VEHICLE OWNERSHIP

CENSUS DIVISIONS	POPULATION GROWTH[a] 1970 - 1978	MEAN HOUSEHOLD[b] MOTOR VEHICLE OWNERSHIP
Mountain	24.1	1.62
South Atlantic	12.7	1.65
Pacific	12.3	1.60
West South Central	9.3	1.71
East South Central	9.3	1.37
West North Central	4.2	1.80
New England	3.5	1.56
East North Central	2.4	1.64
Mid-Atlantic	-1.0	1.47
U.S.	7.3	1.61

Sources: a. U.S. Census, Current Population Report, P-25-790, December 1978.

b. CSI/Westat, Inc., Motor Vehicle Assessment, Vol. 1, Table 5.4.

In general, smaller cars are preferred by younger buyers and by lower income buyers, while older buyers and higher income buyers favor larger cars.[33] Rural households are more likely to own pickups and utility vehicles, while vans are fairly evenly distributed. Pickups are also more prevalent in the Mountain states, and are distinctly less popular in the Mid-Atlantic and New England regions.[34]

With one exception, there is no significant difference between the types of vehicles one- and two-vehicle households own (see Table 4-3). In one-vehicle households 7 percent of all vehicles are light trucks, while in two-vehicle households 21 percent of all vehicles are light trucks.* Light trucks more than any other vehicle are "second" motor vehicles. If trucks are eliminated from the analysis, every other vehicle type is as readily chosen by a one- as by a two-vehicle household. Most two-vehicle households tend to own two different types of vehicles. Only about one household in five owns two vehicles of the same type (see Table 4-4). Where two vehicles of the same type are owned by a household, the choice is most likely luxury or full-sized standard car. Nearly one-third (32 percent) of all two car households have a fleet that is made up exclusively of large vehicles, i.e., full-sized/luxury/pickup/van/utility; and over one in five (22 percent) of the households have a fleet that is made up exclusively of small vehicles, i.e., subcompact-compact/sport/intermediate/foreign. Over half of the two-vehicle households (55 percent) own at least one subcompact/compact or foreign car. All these holdings are strongly influenced by what is available in the market. Since these holdings are for both new and used cars, they are further impacted by what was available in 1976 when the survey was taken as a new car/truck and what was available over the previous ten or more years.

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*These ownership data come from a 1976 University of Michigan Survey Research Center survey. In comparison with other Michigan data, the 7 percent figure appears to be high; the 21 percent figure is more likely low than high.[23] The difference is thus likely even greater than these data indicate.

TABLE 4-3. VEHICLE OWNERSHIP PATTERNS: SINGLE-VERSUS TWO-VEHICLE HOUSEHOLDS

Vehicle Type	Fraction of Vehicles in Each Class			
	Single Vehicle Households		Two Vehicle Households	
	1-Car HH's	All 1-Vehicle HH"s	2-Car HH's	All 2-Vehicle HH's
Subcompact/ Compact	.22	.21	.22	.18
Imtermediate	.21	.21	.20	.16
Full and Luxury	.41	.39	.42	.32
Foreign	.16	.15	.16	.13
Subtotal	1.00	.93[1)]	1.00	.79
All Light Truck	-	.07	-	.21
TOTAL	1.00	1.00	1.00	1.00

1) Sum of above four fractions does not add to .93 because of successive rounding errors.

Source: CSI/Westat, Inc., An Empirical Analysis of Household Choice Among Motor Vehicles, 1979.

TABLE 4-4. TWO-VEHICLE HOUSEHOLD OWNERSHIP PATTERNS (Fraction of Households in Cell)

	Subcompact/Compact	Intermediate	Full and Luxury	Foreign	Pickup	Van	Utility	Marginal Probability of Owning at Least one Row-type Vehicle
Subcompact/ Compact	.029	.053	.104	.041	.043	.014	.024	.168
Intermediate		.039	.073	.043	.053	.004	.014	.159
Full and Luxury			.112	.078	.122	.018	.039	.330
Foreign				.018	.020	.018	.012	.124
Pickup					.002	.002	.010	.128
Van						.002	.008	.035
Utility							.002	.056

Source: Derived from data produced by Cambridge Systematics, Inc., under NSF contract C-PRA77-16108.

4.3 MOTOR VEHICLE CHARACTERISTICS

People in general show a preference for one type of vehicle over another because the preferred vehicle has certain characteristics. Two recent models, one by Cambridge Systematics, Inc. (CSI) and another by Charles River Associates (CRA), have tried to answer this question by analyzing the vehicles people actually owned (CSI) and by analyzing new car market shares (CRA). Since both models are still in development, the results from these analyses are preliminary.

4.3.1 The Cambridge Systematics, Inc. (CSI) Vehicle Choice Model[35]

This model analyzes the vehicles owned by one- and two-motor vehicle households. The model is calibrated with 1976 survey data which include both demographic descriptions of the owners and accurate data on the make and model of the motor vehicles owned. It should be noted that the model does not include three plus motor vehicle households or fleet purchases.

The preliminary results from exercising the model indicate:

a. Seating Capacity - Seating capacity is important. Among one-vehicle households, the preference is for vehicles with 2.5 seats in addition to those required to carry all household members. More or fewer seats decrease the utility. For two vehicle households, the most preferred seating combination is to hold a quite small vehicle and one that is two seats larger. The latter is approximately equal to household size. These results suggest that as households become smaller and as more households own two motor vehicles, smaller cars become more acceptable.

b. Vehicle Weight - Higher vehicle weight is a major factor of significant importance to householders 45 years and over. This is true in both one- and two-vehicle households. To householders below 30 years of age, vehicle weight is only a minor factor and of insignificant importance. To the extent that this "age" is truly a factor of chronological age, the demand for heavier cars will increase as the postwar baby boom ages. However, if this

"age" is a generational measure, the opposite will be true. As the baby boom generation becomes older, more people of older ages should be indifferent to vehicle weight.

c. Luggage Space - Households in general prefer more luggage space. For larger households (four and more persons) with just one car this relationship is significant. For others, the relationship is only of marginal significance.

d. Acceleration - The model indicated that households as a class prefer longer acceleration times to 60 mph (in seconds) and that this is a significant variable for both one-and two-vehicle households. Furthermore, households of all ages have this preference. This result is counter-intuitive, especially if one considers that new vehicles with larger engines and thus shorter acceleration times are more expensive than the same vehicle with a smaller engine. This price relationship has also prevailed in the used car market, at least until the spring of 1979, when some (though not all) of the larger engine premiums were wiped out.

It should be noted that the CSI model does not distinguish between different engine sizes in the car model, as for instance the Chevrolet Impala. The CSI model only distinguished between two different makes and models, as for instance the Chevrolet Impala and the Chevelle, or the Chevrolet Impala and the Ford LTD. To these models CSI assigned the acceleration times they obtained from Consumer Union Reports. For acceleration, this was presumably for the engine size tested by Consumer Union. Whether this engine size is the most frequently owned by the public is a moot point.

The CSI model results with respect to acceleration, while counter-intuitive compared to market prices, are consistent with the results of attitudinal research (see Section 4.4).

e. Vehicle Price - Low vehicle price is of great importance and highly significant for low income households, i.e., for households with income below the Bureau of Labor Statistics middle level budget normalized for household size and location. For households with higher income and owning just one vehicle, the

price of the vehicle is less important and significant only at the 5 percent level.

f. Operating Costs - The groups for whom lower operating costs (in cents per mile) are important and significant are the low income households with one motor vehicle, and the owners of pickups and vans. Low income households with two vehicles, who are the most price conscious on the capital (initial purchase price) cost, "prefer" higher operating costs. These results are not significant, and can be explained by the fact that cheap cars tend to be old cars with poor gas mileage.

4.3.2 The Charles River Associates (CRA) Hedonic Demand Model[36]

This model analyzes the sales shares of new automobile sales by analyzing the demand for selected vehicle characteristics including price. The model apparently does not consider the need for the manufacturers to clear the market (see Section 2.1.3). Instead, the model seems to assume that the sales during a period of time are a function of demand at a fixed price, and that any supply/demand imbalance at this price is absorbed in inventory changes.

The preliminary results from this model indicate that to new car buyers luxury is much more important than interior space and that luxury (defined as a function of ride quality and noise level) is a prime determinant of car choice. The model estimates a median fuel cost coefficient which is extremely low. CRA believes that this is due to the exclusion of variables which are correlated with fuel cost. Such variables might be weight desired for its presumed relationship to durability and safety, or streamlined styling, which is generally packaging inefficient. The model is currently being respecified and reestimated.

4.4 ATTITUDES TOWARD FUEL EFFICIENT VEHICLES

During 1978, National Analysts, Market Facts, and Charles River Associates separately conducted series of group interviews

and group experiments on consumers' attitudes towards fuel efficient vehicles.[37,38,39,30] These studies were sponsored by NHTSA. The methodologies and findings of these studies are discussed in Part III of this report. The discussion in this section places the general findings of these studies completed prior to June 1979 in relation to the motor vehicle market and the AFER program.

4.4.1 Attitudes Toward the Energy Crisis and Energy Conservation

In 1978, people were in general very skeptical of the "energy crisis." Rising prices and gas shortages at the pump were seen to be the results of conspiracies by the oil companies and the Arabs, and bungling and favoritism by the government.

This skepticism and cynicism toward the energy crisis appears to have been, however, one more of confusion than deeply held belief. Most people were willing to acknowledge that oil is a non-renewable resource and that some conservational measures are in order.

The shallowness of the attitudes about the energy crisis in part explains the strong demand induced market share vacillations of the post-1973 period. First came the decline in large car shares in 1974; next, the rise in large car/large light truck shares in 1976 through mid-1978 when gasoline prices were rising at a rate lower than the inflation rate, and lastly, the sharp decline in large car/large light truck sales in 1979.

Most people stated that they have made some efforts to reduce their consumption of fuel. This, however, occurred for reasons of economy, as part of saving money, not from a desire to conserve fuel. Most conservation efforts mentioned centered on saving heating fuel, or the choice of the last car. Reducing driving was mentioned mainly in connection with life cycle changes (children forming their own household, retirement, etc.).

There were also two more extreme minority views. One used its cynicism about the crisis to justify wasteful behavior. The typical attitude was "If you have it -- flaunt it." This attitude

in the market place expressed itself in a desire for large, gas guzzling cars and trucks regardless of need. The other minority view was held by people who saw themselves as personally responsible for some small effort toward conserving a dwindling resource, and thus limited their vehicle use on ideological grounds.

4.4.2 Attitudes Toward CAFE Regulations[38]

The complexity of feelings about the energy crisis was matched by the complexity of reactions to the Corporate Average Fuel Economy regulations. While a few people opposed the regulations on the basis of doubts about the wisdom of government intervention in a free enterprise economy, support for the program was widespread and familiarity with it appears to have increased between the spring and fall of 1978. Motivation for the support varied:

a. The most frequently encountered interpretation of the law was that it is consumerist in intent; the government is finally going to do something about the high price of gasoline. From this perspective, it is puzzling and irrational for the government to, on the one hand, move to lower the cost of gasoline, but on the other hand, do it in such a manner that the price of automobiles will rise. Many of these people also did not perceive the government as being very effective in the field of consumer legislation, and expressed fears that the law will not be enforced.

b. Another frequent attitude was that the law is some sort of punishment levelled against the automakers and the oil refiners for being so greedy as to have contrived the fuel crisis in the first place. Where this punitive intent was perceived, it was applauded on the grounds that if left to their own devices, the corporations would only increase their exploitation of the consumer. Again, those holding this view feared that the corporations would find some way around the law, and the most cynical suggested that the law was a public relations device or a meaningless gesture.

Interestingly, the necessity for government intervention is a position that flows logically from both the conspiracy theory

of the energy shortage, and the conservation-of-a-finite-resource approach.

c. Support for the view that the law is doomed to be ineffective was found in the EPA fuel economy labelling program, which elicited almost univeral disbelif and irritation. The general feeling seemed to be that if the government issues such notoriously inaccurate fuel economy figures, what benefit could come from any other government effort in the field of automotive fuel economy? Fine distinctions between DOT and EPA were lost; the government puts the stickers on new car windows, and the government passed this newer law. Still further evidence that the government is not really serious about fuel economy is the continuing requirement that cars, and increasingly trucks, carry emission control equipment which the holder of these views said makes the engine run less efficiently, and also requires that they purchase more expensive unleaded gasoline.

d. Finally, a vocal minority saw the law as either unnecessary or as proof of the government's weakness in the face of corporate power. These are the people who truly believe in suppressed technology, like 80 mpg carburetors or pills which turn water into gasoline. The whole government effort in the area of automotive fuel economy is then irrelevant, even damaging. A milder version of the same thought process occurred when group participants clutched at synthetic fuel research as a way of avoiding the need for legislation.

4.4.3 Attitudes Toward Passenger Car Attributes and Fuel Economy Options[39]

From consumer experiments one can infer the trade-offs between attributes (as for instance, gas consumption vs. acceleration) which the average consumer will make. However, it is also very revealing in these studies, which were conducted in December 1978, that there is considerable polarization among consumers. In other words, one person will be satisfied with sluggish acceleration to gain higher fuel economy, while another

person will insist on quick acceleration regardless of what happens to fuel economy. The experiments considered five vehicle attributes: gas consumption, servicing, acceleration, interior room, and vehicle size (full-size, mid-size, compact, mini/subcompact).

The data from the experiment reveal that consumers prefer favorable levels of gas consumption and service frequency to other vehicle attributes. Relative to other characteristics, interior room and trunk space are valued least. More importantly, the data suggest that people are willing to trade-off some degree of vehicle size, interior and trunk space, and acceleration, in order to maximize fuel economy. At the same time, consumers are not willing to trade-off infrequent servicing of the car for enhanced fuel economy. This suggests that any technical advance in fuel economy which increases the frequency with which the vehicle must be serviced might be resisted. The importance which people attach to infrequent servicing may be one explanation for the decreasing proportion of used car to new car purchases.

The average respondent in each passenger car size class showed the same primary concern for gas consumption followed by servicing. For subcompact and compact car owners, acceleration was the third most important criterion, for mid-size and full-size owners it was vehicle size. The mid-size car was the preferred vehicle size for these owners, as well as for the owners of compact cars. Size, not surprisingly, was of least importance to the subcompact owners. These owners showed equal preference for compact and mid-size cars.

The experiments indicate that by the criteria test the preferred car is fairly independent of the vehicle people presently own. In turn, this suggests that other automobile criteria are also important in the vehicle choices people make. Cost, comfort, handling, safety, and prestige are such possible criteria.

In the same group of experiments, researchers tested the attitudes toward three fuel economy options: downsizing, diesel

engines, and material substitution. The experiments showed no uniformity of opinion about the three options. On the contrary, people expressed polarized reactions to all three options. While better than one-third rated each option as highly desirable, one-fifth to one-quarter rated each as not at all desirable. On a relative basis, downsizing is preferred over the other two fuel economy options. Material substitution is the least acceptable.

The diversions of these attitudes, even with the general preference for the mid-size car, make it clear that there is no one basic car on which a large majority of consumers can agree. To the extent that there is agreement, there are sizable minorities on either side of the consensus. Thus, the world car, which with minor variations can satisfy the needs of most, appears to be far from a market reality. In contrast, the old Sloan slogan of "a car for every purse and purpose" appears to better reflect current consumer attitudes.

4.4.4 Attitudes of Large Vehicle Owners

Large gas guzzling vehicles, i.e., full-sized cars, conventional pickups, and vans, will be affected in their design and/or availability by AFER more than any other classes of vehicles. This section summarizes the attitudes expressed in the group discussions by owners of these vehicles on why they own, need, and desire one of these types of vehicles, and the trade-offs that would be most acceptable. The expressed attitudes were voiced in early 1978. All these owners are owners of late model vehicles, that is vehicles which were bought after the Arab Oil Embargo. Furthermore, the owners of the full-sized cars bought their vehicles in a vehicle market in which the full-sized car share was about half what it was prior to 1973. These buyers are thus in some respect the embattled minority which held out for full-sized cars when others were deserting the market. In contrast, the light truck buyers bought their vehicles in a rapidly expanding market. They went along with the trends of the times.

a. Attitudes of Full-Sized Car Owners[37,40]

The reasons for owning full-sized cars varied: big drivers who want room inside to stretch out, people with large families to carry, desires for luxury and prestige, or the "big-car ride." Besides these obvious reasons, the other recurring theme in all group interviews was safety. Owners of big cars say they feel safer in them. Taken alone, this might be dismissed as an apparent sober rationalization of status hunger or resource squandering if it were not for the frequency with which small car owners express fear for their safety as result of vehicle size. The linkage between size and safety is nearly universal, although developed strongest among big car owners.

The full-sized market is quite heterogeneous. Owners of luxury cars generally emphasize ride quality and driving comfort, while owners of standard cars are more concerned with interior room and trunk space.

The fact that these cars have poor gas mileage is generally acknowledged by their owners. Luxury car drivers tend to shrug it off with an "I can afford it." Among others it is frequently pointed out that driving a big car a relatively low number of miles per year did not entail a disproportionate use of scarce fuel. Car pooling was used to justify the bigger car, both in number of miles driven and in the use of scarce fuel. There is also some evidence in these group interviews that in multi-car households of a large car and a small car, the full-sized cars are driven less than the smaller cars.

Full-sized luxury car owners and other full-sized car buyers split sharply in the trade-offs they would accept. The former were more willing to give up size. Import luxury cars were mentioned as acceptable substitutes for large American luxury cars. The owners of non-luxury full-sized cars and station wagons would typically sacrifice power to size. Downsizing to the extent of the 1977 GM cars was viewed as acceptable. With some exceptions, the light truck was not seen as a reasonable alternative among full-sized sedan owners. But for full-sized

station wagon owners, vans and pickups were seen as logical alternatives, especially in an era of downsizing.

The most consistent attitude on trade-offs concerned material substitution. There was a consistently negative attitude to the use of lighter weight materials, especially plastics.

In reviewing the attitudes of full-sized car buyers and their strong emphasis on safety which they feel is inherent in the weight and crush space of large cars, one wonders what the impact of passive restraints, will be on this class of buyers. With these safety devices, will smaller cars be more acceptable to them?

b. Attitudes of Conventional Pickup Owners[37]

Pickup owners, which were nearly exclusively male in the group interviews, are happy with their vehicles, perhaps happier than any other class of owners. Under the circumstances this is hardly surprising, for these, according to the trade and fan magazines, are the owners of the rugged he-man vehicle, the new muscle vehicle. Since most pickups are owned jointly with a passenger car, they often are "his" vehicle (particularly for the persons who participated in these interviews), while the sedan may be "hers" and the family car. In other words, interviews with the women of pickup owning households may have yielded quite different results. Thus, the euphoric attitudes should be taken with a pinch of salt.

Work and recreation compete for the number one spot among reasons for buying a conventional sized pickup truck. However, the competition is more apparent than real, since the two motivations usually show up together. But it is this very versatility that is particularly prized in pickup trucks, and they are typically bought to fulfill multiple, unrelated purposes.

Owners are impressed with comfort and visibility afforded by the pickup cab, with the ease of maintenance, and with the greater durability of the pickup truck. The standard of comparison typically is the station wagon, and many pickup owners are

previous station wagon owners. Owners are hard pressed to come up with disadvantages of pickups. One disadvantage mentioned is limited cab space, but this is solvable with crew cabs, which a few intend to order on their next pickup.

From the point of fuel economy, there is little dissatisfaction. The feeling is prevalent that pickups do as well as station wagons, particularly with heavy loads. The only real complaints about fuel economy came from participants who had emission control devices on their vehicles. Their anger was directed at the EPA, and not at the manufacturer or at pickups as a vehicle class.

In discussing trade-offs, there were strong reactions against downsizing. Conventional pickup owners do not at all like the small imported pickups. The indictments against these vehicles involve cab room, ride, lack of durability, and failure to deliver on gas mileage when towing or under load.

Pickup owners were much more willing to give up some power than to sacrifice room, and room in these discussions is frequently defined as carrying a 4' x 8' panel lying flat. Horsepower reductions appear acceptable as long as the torque is maintained. Diesel engines are acceptable, although there is considerable awareness of their shortcomings in terms of noise, odor, cold starts, and initial cost. Next to outright downsizing, light weight materials were the least acceptable alternative, probably because they clash with the image of durability.

c. Attitudes of Van Owners[37]

Compared with full-sized pickups, the van owners seem to be more people-oriented; they talk more about being able to haul large numbers of people, or sleep in their vans, or decorate it as a movable human environment. Vans even more than pickups are compared to station wagons. Still, vans are also cargo carriers, and some preferred them to pickups because of the closed cargo area, which assures privacy and permits them to stack cargo higher than they could in a pickup.

Poor fuel economy is the major perceived disadvantage. In addition, some indicated that they really do not enjoy driving their vans because of their bulkiness, but the general consensus appears to be that the utility of vans outweighs the difficulty of "getting them around."

Van owners' reactions to likely vehicle design changes are not very different from those of other motorists. They will give up power before giving up anything else, they do not want to downsize, and they oppose light weight materials on grounds of safety, rather than durability.

In the motor vehicle characteristics analysis (Section 4.3), the negative utility of acceleration is considered counter-intuitive. Who would want less rather than more? However, this behavioral trait is underscored in these attitudinal studies where power (or acceleration) is the first thing most persons are willing to sacrifice in their vehicles.

4.5 CONSUMER EXPENDITURE TRENDS

This section analyzes the impact of the demand for motor vehicle ownership and cost of motor vehicle transportation on household finances and expenditures.

During the 1970s, households increased their motor vehicle ownership holdings; most of these increases occurred in the second half of the decade. These increases (see Section 4.1) were generated more by increases in households owning multiple vehicles than by increases in households owning at least one vehicle. This relationship holds for all household income quintiles, though there were also substantial increases in the number of households owning at least one motor vehicle in the two lowest income quintiles.[41] The increase in multi-car households is apparently associated with the rise in two worker households, or the increased labor force participation rate of women under 45 years of age (see Section 4.1).

In spite of the increases in labor force participation, the real income of most households did not change materially.[42]

Median household income in constant dollars was the same in 1970 and 1977. Mean real income advanced by 3 percent between 1970 and 1977. (See Table 4-5).

On a per capita basis, real income in 1977 was 15 percent higher than in 1970. The per capita income growth which is not reflected in household income growth is due to the fact that the average household size declined, mainly, but not exclusively, due to a decline in children per household. This decline in children arises from the low birth rate, which since 1973 reflects fertility rates below the population replacement level.[43]

How have households financed their rise in motor vehicle ownership without any real income growth? Inflation has neither helped nor hindered the households' needs for greater motor vehicle ownership. Overall the cost of user operated motor vehicle transportation has increased commensurate with the general inflation rate. The consumer price index for new cars has generally lagged behind the general inflation rate, but this difference is more apparent than real, since this index does not include the new car price changes which are due to quality changes (see Part II, Section 9). If these changes are factored into the price index, then new car prices vary with the inflation rate.

The gasoline price increases of 1979 are one exception to these rules. These increases have propelled the gasoline price index well above the general inflation rate. The impact of these price increases on motor vehicle ownership awaits to be seen. In addition, the cost of automobile repair has increased slightly faster than the general price inflation.

Without help from inflation, there are essentially three ways in which households can finance their increased need for motor vehicles:

a. By driving older motor vehicles,
b. By increasing their motor vehicle expenditures, and
c. By increasing the time period over which motor vehicle purchases are financed.

TABLE 4-5

HOUSEHOLD INCOME (1970-1977)

Current Dollars	Median Income	Mean Income	Per Capita Income
1977	$13,572	$16,100	$5,730
1976	12,686	14,922	5,220
1975	11,800	13,779	4,767
1974	11,197	13,094	4,458
1973	10,512	12,157	4,099
1972	9,697	11,286	3,743
1971	9,028	10,383	3,389
1970	8,734	10,001	3,205
Constant (1977) Dollars			
1977	$13,572	$16,100	$5,730
1976	13,504	15,885	5,557
1975	13,286	15,514	5,367
1974	13,759	16,090	5,478
1973	14,335	16,578	5,590
1972	14,046	16,348	5,422
1971	13,509	15,536	5,071
1970	13,630	15,608	5,002

Source: U.S. Census, Current Population Reports, P-60-117, P-60-117, December, 1978

American householders used all three methods during the 1970s.

a. Driving Older Motor Vehicles: Although TSC has no direct statistical evidence that households are now driving older motor vehicles compared to the early 1970s, there is considerable indirect evidence. The expected vehicle life for passenger cars has increased (see Section 3.3 and Part II, Chapter 2). Households own more light trucks which have longer expected vehicle lives than cars. Business car and light truck fleets (see Part II, Section 3) usually sell their vehicles in the used vehicle market rather than hold them until scrappage; thus, the older cars and light trucks are generally in the household fleets, and any gain in expected vehicle life accrues to the benefit of the household fleets.

b. Increasing Motor Vehicle Expenditures: The increased need for motor vehicle transportation in the 1970s was so great that households increased the percentage of their total expenditures devoted to user operated transportation (see Tables 4-6 and 4-7). In 1970, less than 12 percent of consumer expenditures went to user operated transportation. By 1978, nearly 14 percent went to motor vehicle transportation. In the first quarter of 1979, this percentage was still climbing.[44] In general, consumers are spending less on new cars and more on used cars than earlier in the decade. Not surprisingly, in 1978 gasoline was accounting for more of the consumer dollar than in the early 1970s, but less than in 1974 and 1975. In the first quarter of 1979, gasoline again accounted for 4.1 percent of the consumer dollar, or the same as in 1974. Slowly through the decade, consumers have increased their allotment for repairs and for other motor vehicles, mainly light trucks. The expenditure shifts of American households are those one would expect of people who keep their vehicles longer and drive generally older vehicles.

What did the American public give up to afford the extra vehicles per household on virtually constant income? One can answer this question only indirectly, since user operated transportation was only one of the items for which the average

TABLE 4-6. PERSONAL CONSUMPTION EXPENDITURES PER HOUSEHOLD (IN CURRENT DOLLARS)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Total Expenditures	9,531	10,001	10,733	11,586	12,494	13,430	14,713	15,875	17,247
Transportation	1200.2	1356.7	1485.2	1586.0	1616.4	1721.4	2029.7	2264.5	2491.1
User Operated Transportation	1115.0	1269.1	1396.0	1492.4	1513.1	1616.7	1915.2	2140.2	2354.3
New Auto			470.1	494.1	386.5	411.9	529.2	608.7	651.3
Net Used Auto	487.6	604.6	106.9	119.6	123.9	139.8	187.1	204.0	221.1
Other MV			79.9	84.4	66.4	77.9	119.9	134.6	148.6
Tires, Tubes, Acces.	88.0	94.4	83.3	91.6	97.1	102.9	112.6	124.9	133.9
Gasoline & Oil	342.8	352.3	364.3	397.9	511.7	542.0	577.9	611.3	658.8
Repairs	134.6	144.3	203.8	220.5	247.3	279.7	312.1	340.6	375.2
Bridge & Road Tolls	8.4	8.7	10.9	11.2	10.7	10.9	11.5	11.6	11.8
Ins. Prem. & Claims	53.7	64.7	76.8	87.5	69.4	51.7	72.7	104.5	153.7
Number of Households (Millions)	64.8	66.7	68.3	69.9	71.2	72.9	74.1	76.0	77.7*
* Estimate									
(IN 1972 DOLLARS)									
Total Expenditures	10,245	10,347	10,733	10,983	10,684	10,625	11,057	11,285	11,476
New & Net Used Auto	492.9*	587.1*	577.0	602.3	466.9	456.3	543,1	584.6	582.7
Other MV			79.9	84.4	62.8	67.6	96.5	104.6	107.3
Tires, Tubes, Acces.	75.7	79.2	83.3	94.3	93.5	90.5	93.3	100.5	103.5
Gasoline & Oil	347.0	351.5	364.3	364.6	346.2	342.9	350.6	349.2	361.7
User Operated Transportation Services (Repairs, Tolls, Ins.)	288.6	290.0	291.5	302.0	305.0	305.5	307.2	313.7	342.0

*Estimate

Source: U.S. Department of Commerce Survey of Current Business, July Issues 1973-78. 1978 data from DOC computer printout.

TABLE 4-7

PERSONAL CONSUMPTION EXPENDITURES PER HOUSEHOLD
PERCENT OF TOTAL EXPENDITURES (1970-1978)

	1970	1971	1972	1973	1974	1975	1976	1977	1978p
Total Expenditures	100	100	100	100	100	100	100	100	100
Transportation	12.6	13.6	13.8	13.7	12.9	12.8	13.8	14.3	14.4
(User Operated Transportation)	11.7	12.7	13.0	12.9	12.1	12.0	13.0	13.5	13.7
New Cars			4.4	4.3	3.1	3.1	3.6	3.8	3.8
Net Used Cars	5.1	6.0	1.0	1.0	1.0	1.0	1.3	1.3	1.3
Other Motor Vehicles			.7	.7	.5	.6	.8	.8	.9
Tires, Tubes, Acces.	.9	.9	.8	.8	.8	.8	.8	.8	.8
Repair	1.4	1.4	1.9	1.9	2.0	2.1	2.1	2.2	2.2
Gasoline & Oil	3.6	3.5	3.4	3.4	4.1	4.0	4.0	3.9	3.8
Bridge & Rd. Tolls	.1	.1	.1	.1	.1	.1	.1	.1	.1
Ins. Prem. Less Claims	.6	.6	.7	.8	.6	.4	.5	.7	.9

Source: U.S. Department of Commerce, Survey of Current Business, July Issues 1973-78. 1978 data from DOC computer printout.

household allotted extra money (see Table 4-8); other items including housing, household operation, medical expenses, and recreation. With the exception of medical expenditures, which took an extra 2.2 cents of the consumer dollar, these expenditure increases were minor. U.S. families cut back their expenditures mainly on clothing (2.4 cents of the consumer dollar) and on food (1.5 cents). Other expenditure reductions included personal care, personal business, private education, religion and welfare, other transportation expenditures, and net foreign travel. Since the average household had fewer children in 1978 than in 1970, expenditure reduction on clothing and food appear natural to pay for medical services and more user operated transportation.

c. Increasing Term for Motor Vehicle Financing: During the 1970s, householders have financed their motor vehicle purchases increasingly on credit. Automobile installment debt increased nearly threefold between 1970 and 1978 (see Table 4-9). Automobile papers accounted in late 1978 for nearly 6 percent of personal income, up from 4.5 percent in 1970. To carry this increased debt, consumers have extended the contract terms of these debts and have had to increase their average monthly payments (see Table 4-10). This increase in monthly payments is roughly at the rate of inflation. There is little doubt that the availability of consumer credit has enabled the average householders to increase their motor vehicle fleet. These debts, and especially their extended terms, make it likely that the recent new motor vehicle purchasers will not be able to return to the new motor vehicle market for a longer period of time than new vehicle purchasers of earlier in the decade.

Motor vehicle debt has had its sharpest increases since 1975, or since the passage of AFER, although there is probably no causative relationship. New car purchases are absorbing a relatively stable proportion of total household expenditures, and far less than in 1972-73. Since this proportion has not increased, the sharp rise in motor vehicle loans may be more a function of the

TABLE 4-8

PERSONAL CONSUMPTION EXPENDITURES
BY EXPENDITURE CATEGORIES (1970-1978)(%)

	1970	1971	1972	1973	1974	1975	1976	1977	1978p
Food/Tobacco	22.9	22.1	22.2	22.4	22.9	22.9	22.2	21.7	21.4
Clothing	10.2	10.1	8.8	8.9	8.6	8.4	8.1	7.9	7.8
Personal Care	1.7	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.4
Housing	14.7	14.9	15.3	15.2	15.3	15.3	15.3	15.3	15.5
Household Operations	14.1	14.1	14.3	14.5	14.7	14.5	14.6	14.7	14.6
Medical Services	7.7	7.8	8.3	8.4	8.6	9.1	9.6	9.8	9.8
Personal Business	5.7	5.7	5.1	5.0	5.1	5.3	5.1	5.0	4.9
Transportation	12.6	13.6	13.8	13.7	12.9	12.8	13.8	14.3	14.4
(User Operated Transportation)	11.7	12.7	13.0	12.9	12.1	12.0	13.0	13.5	13.7
Recreation	6.6	6.4	6.7	6.8	6.8	6.8	6.7	6.7	7.0
Private Educ.	1.7	1.6	1.6	1.6	1.5	1.6	1.6	1.6	1.5
Religious	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.2
Foreign Travel, other	.8	.8	.8	.6	.6	.5	.4	.4	.4
Total Personal Consumption Expenditures	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: U.S. Dept. of Commerce, Survey of Current Business, July Issues 1973-78. 1978 data from DOC computer printout.

TABLE 4-9

AUTOMOBILE INSTALLMENT CREDIT (1970-1978)

Year	Automobile Papers Outstanding (Billion $)	Percent of Personal Income
1970	35.2	4.4
1971	39.4	4.6
1972	46.6	4.9
1973	52.4	5.0
1974	52.9	4.6
1975	55.9	4.5
1976	66.1	4.8
1977	79.4	5.1
1978 (Oct.)	100.2	5.9

Source: Federal Reserve Bulletin, Monthly, 1970-78.

TABLE 4-10

AVERAGE NEW CAR MONTHLY PAYMENT
CONTRACT TERMS AND PERCENT FINANCING
FOR 37-48 MONTHS (1974-1978)

	1974	1975	1976	1977	1978
Avg. Monthly New Car Payment ($)	132	146	157	163	174
Avg. Contract Term (months)	34.1	34.7	35.6	37.7	40.0
% Financing for 37-48 (months)	4	16	27	43	60

Source: GMAC data in Ward's Automotive Reports, Vol. 54, No. 8, (February 19, 1979)

ease with which credit for motor vehicles is obtainable and the fact that it is offered at lower rates than credit for most other household purchases, rather than a function of the price of motor vehicles.

5. MARKET OUTLOOK

The motor vehicle market, at least since World War I, has been in a state of flux. While the direction of the total market has been one of growth, this growth has been cyclical. Meanwhile, both the product and the use of the product underwent many changes. In recent years, the market has been far from steady. As a direct result of AFER, a number of new model designs have been introduced, and more new designs and technologies are expected in the early 1980's. Meanwhile, consumers, trying to adjust to these new offerings, have created highly erratic sales charts for many models. To this fluid situation one can add, in 1979, recurring gasoline lines and sharp increases in the price of gasoline. These two factors will certainly affect the market for many years. Forecasting, always precarious, becomes thus even more precarious. The best one can say of the future motor vehicle market is that the picture is cloudy.

5.1 ECONOMETRIC FORECASTS

The motor vehicle sales projections of Chase Econometric Associates, Inc., Data Resources, Inc, and Wharton Econometric Forecasting Associates, Inc. are shown in Figure 5-1. Chase projects only automobile sales. DRI and Wharton project both automobile and light truck sales. The automobile sales forecasts are, with one exception, very consistent with one another, differing by less than one million cars in any one year. The forecasts have their greatest divergence in 1980 when Chase projects a longer and steeper recession and DRI a slight upturn. Over a ten-year period, these forecasts vary between 1.0 and 1.5 percent annual growth.

The light truck projections of Wharton and DRI show major but consistent differences. Wharton projects far greater light truck sales than DRI; Wharton projects annual sales increases of over 5 percent, while DRI estimates a 3.5 percent annual growth.

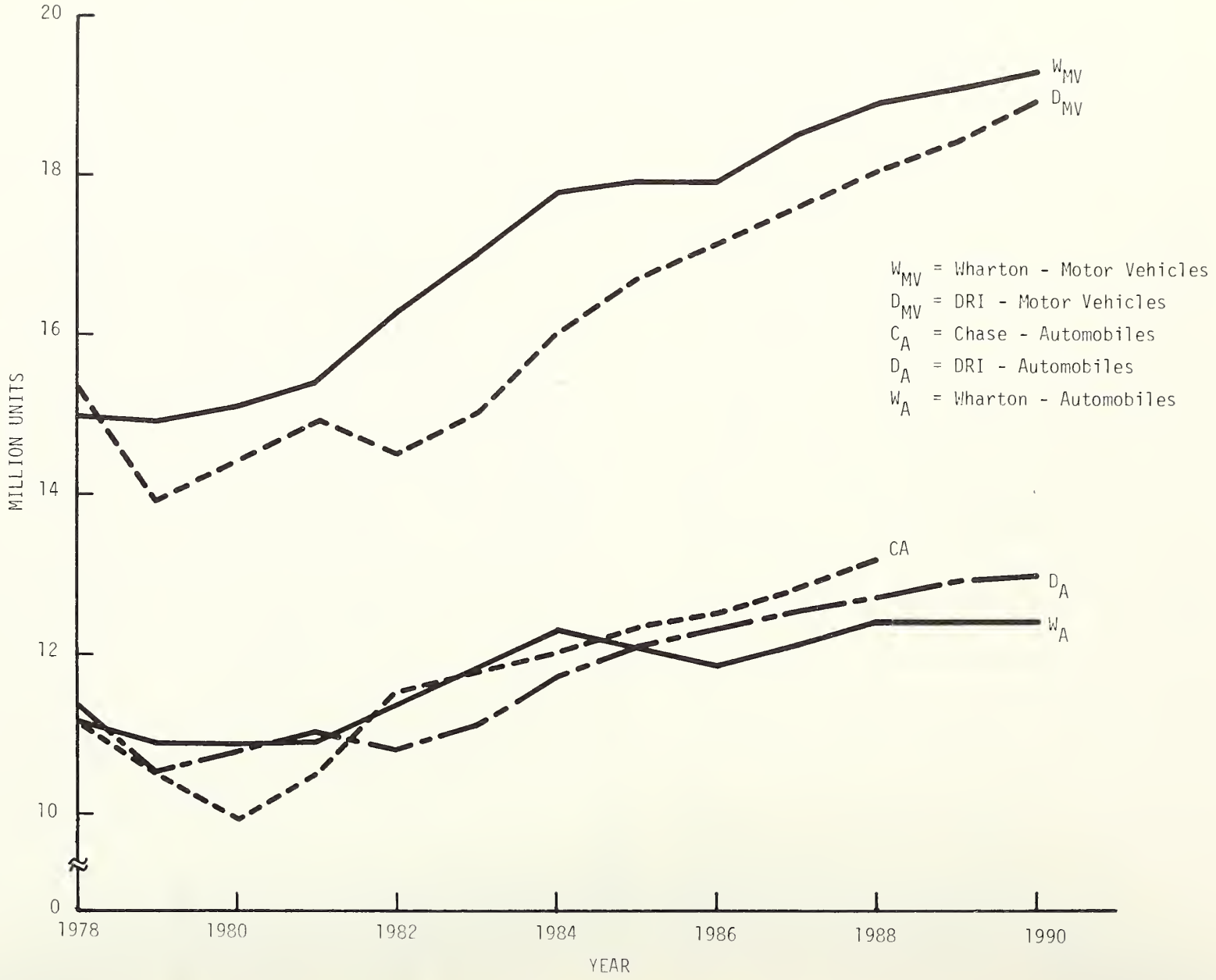

FIGURE 5-1. MOTOR VEHICLE SALES PROJECTION (SPRING 1979)

Wharton projections imply that the 25 percent light truck share of 1978 will expand to a 33 percent share by 1985, and to a 37 percent share by 1990. DRI projects that light truck sales will be 28 percent of all motor vehicle sales in 1985 and 31 percent in 1980.

Although Wharton's new car sales projections are generally below those of DRI, Wharton projects higher automobile usage (VMT) than DRI (Figure 5-2). Both DRI and Wharton project uninterrupted growth in VMT. DRI's growth in VMT through 1985 is 1.6 percent annually. This is below the U.S. Census lowest projection for household formation, and thus considerably less than the growth in the 1970s.[45] Wharton's VMT growth rate is about 3 percent annually, a rate comparable to the VMT growth rate since the 1974-75 recession.

5.2 SOCIAL TRENDS

The econometric forecasts are based on the expected trends in the size and age composition of the U.S. population and general macro-economic activities. This section deals with social trends which could modify the demand for motor vehicles and which are generally omitted from econometric forecasts. Specifically, the focus will be on the social trends that can modify the demand for motor vehicle ownership per household, the market share for light trucks, and the market share for small cars.

5.2.1 Trends Affecting Motor Vehicle Ownership Per Household

Between 1978 and 1985, DRI projects an increase in total new motor vehicle sales of 12 percent. This is the same rise as the lowest Census projection of growth in households. Wharton projects an 18 percent rise; this equates with the highest Census projection of growth in households.

New motor vehicle sales projections below the household formation rate imply that the average household reduces its motor vehicle holdings, or, owns older motor vehicles. The latter is a feasible option in periods when high gasoline prices reduce driving.

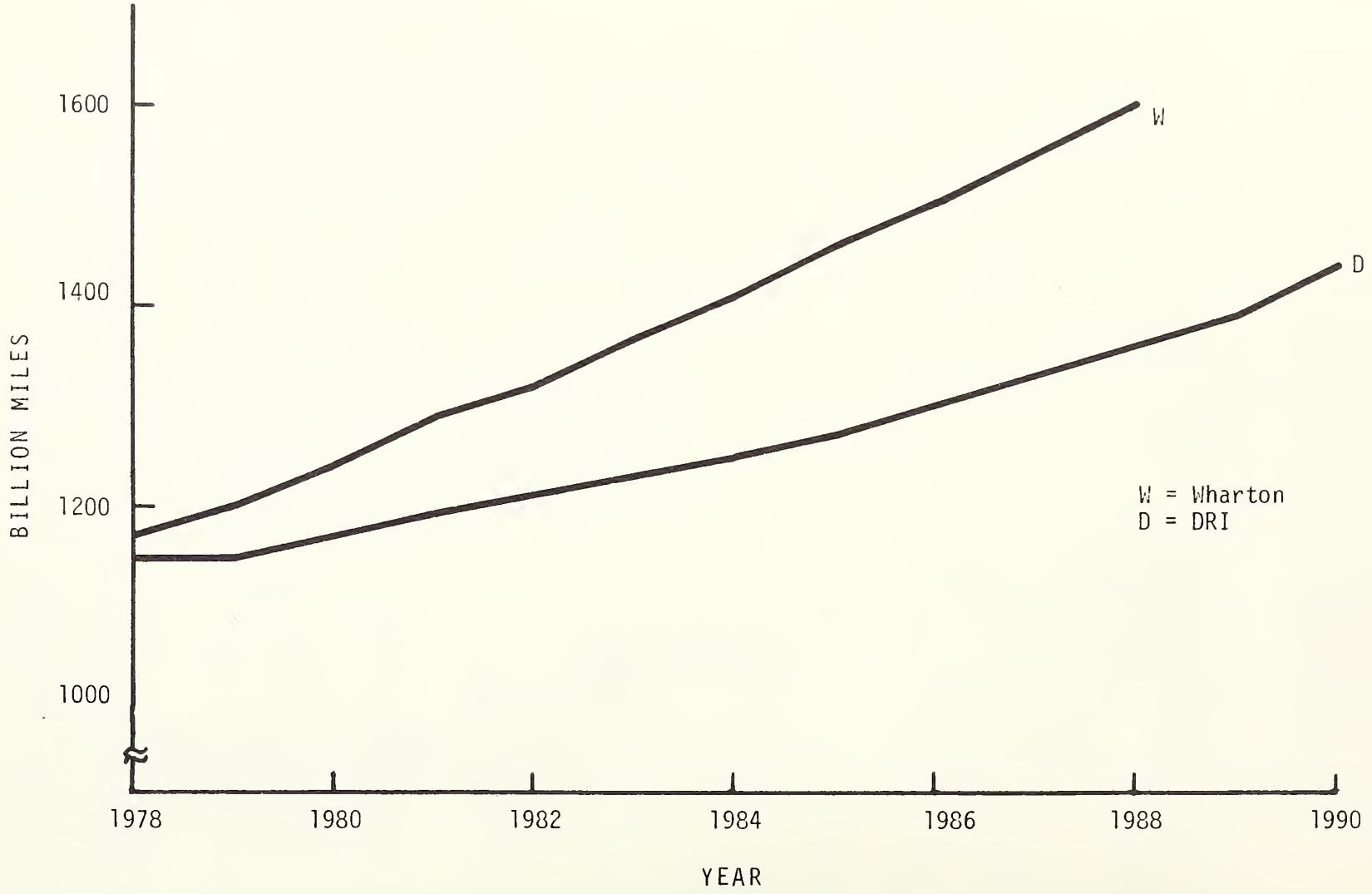

FIGURE 5-2. AUTOMOBILE VMT PROJECTIONS (SPRING 1979)

Factors favoring increased ratios of motor vehicles per household are:

a. Low household formation rate. That is, employed singles increasingly live with their parents rather than set up their own households. This is a reversal of 1970 trends. People postpone first marriage. This is in tune with 1970 trends, but is mitigated by the increased number of households consisting of unmarried couples.[46]

b. Increased labor force participation by women of child bearing age. This is a continuation of 1970 trends. However, 1979 is the seventh year of births below the replacement level, and there are indications that the birth rate among women above 30 is rising.[47] On the other hand, the lack of growth in real median income per household favors higher labor force participation rates and low fertility rates.

c. Actual or standby gasoline rationing schemes that are based on registered vehicles. Households would receive more gasoline if they had more motor vehicles.

Factors favoring lower ratios of motor vehicles per household are:

a. Peaking of the proportion of consumer expenditures devoted to user operated transportation; this includes rises in the cost of user operated transportation above the general inflation level.

b. Programs that encourage car and van pooling.

c. Improvements in the availability and use of public transportation. Since June 1977, there has been a steady month by month rise in the use of public transportation.[31]

d. Improved home delivery of goods and services by providers or their agents. This would require a radical trend reversal, and appears quite unlikely, unless there is severe gasoline rationing that is not tied to motor vehicle ownership, but to households or drivers licenses. In this case businesses may find

it advantageous to introduce regularly scheduled frequent delivery services.

5.2.2 Trends Affecting the Light Truck Market Shares

The lack of unanimity among econometricians on the factors affecting the demand for light trucks is apparent from the differences between Wharton's and DRI's light truck projections. The trends listed here are based on market observations and are not firmly grounded in quantitatively tested hypotheses or statistical analyses.

Light trucks, mainly the pickup but also the van, appear to be the 1970s successor to the convertible, the disappearing large station wagon, and the large sedan. With the disappearance of the convertible and the lowering (streamlining) of the roof of the sedans and large station wagons in the 1960s, the pickup truck became the natural answer for those who wanted to carry bulky goods, and the van for those who wanted to carry lots of goods. The recent conversion of some business fleets from station wagons to vans is typical of this trend.[48] Furthermore, the pickup and the van are the economic answers for many drivers when compared to full-sized cars and station wagons (see Part II, Section 5). Until 1979, the lower initial, depreciation, and maintenance costs tended to favor the pickup over the sedan's frequently better fuel economy. In the spring of 1979, sales of the "5/8 ton" pickups, which no longer enjoy the advantage of burning leaded fuel, fell even more than those of large cars. Meanwhile, the sale of mini-pickups spurted. Clearly, many demand the capability to carry bulky goods, but cost is also a very definite consideration. In attitudinal research, the 4' x 8' plywood panel lying flat seems to typify the demanded carrying capacity of a light truck.

Factors favoring increased light truck market share are:

- Favorable total cost differential between full-sized cars and light trucks, both pickups and panels.
- Increased use of light trucks by one motor vehicle households.

o Lack of delivery services; stores charging for delivery of major purchases.

o Any new fad that requires the movement of bulky or of many objects; this will, however, always be a small market.

o Increased activities in new business formation. This appears to be an important factor in the rise of light truck sales during the 1970s.

Factors impeding further growth of light truck market shares are:

o Apparent saturation of the agricultural and self-employed market (see Section 3.2.2). This may be followed by market saturation among other professional groups.

o Decline in recreational vehicle market (see Part II, Section 6) and apparently also in recreational travel (see Section 2.3.3).

o Decline in the youth market. This factor should not become noticeable until the mid or late 1980s.

o Regulations affecting the cost or operation of trucks and favoring sedans.

5.2.3 Trends Affecting Small Car Market Shares

Small cars and mini-trucks represented over half the motor vehicles sold in May 1979.[21] These are certainly the success vehicles of the 1979 energy shortage. If the supply of many of these models were not limited, their sales share might have been even greater.

Factors favoring increased small car market shares are essentially economical:

o High gasoline prices and the expectation of gasoline rationing.

o High labor force participation rates. More workers per household increases likelihood of multi-motor vehicle

households. Two motor vehicle households are satisfied with smaller sized vehicles, than one motor vehicle households. (See Section 4.3.1.)

o High percentage of household expenditures devoted to user operated transportation. This forces the saving of expenditures on motor vehicle purchases, which in turn implies less costly, i.e., smaller cars or light trucks.

Factors impeding growth of small car market shares are:

o Low capital and operating cost differences between small and medium sized cars, the most preferred car size.

o Safety considerations; active campaigns of labeling small cars unsafe.

In general, the motor vehicle market of the 1980s will be affected by the changes in the economic and demographic conditions, and the socio-economic adjustments the American public will have to make to absorb the expected sharp increases in the price of petroleum products.

APPENDIX A

REFERENCES

1. Motor Vehicle Manufacturers Association (MVMA) Motor Vehicle Facts and Figures '78, Detroit, 1978, p. 39.
2. Ralph Nader, Unsafe at Any Speed; the Designed-in Dangers of the American Automobile, New York: Grossman Publishers Inc., 1965.
3. Wharton EFA, Past and Future Trends in Automobile Sales, in publication, p. 44.
4. L.B. White, The Automobile Industry Since 1945, Harvard University Press, 1971, p. 74.
5. L.B. White, The Automobile Industry Since 1945, Harvard University Press, 1971, p. 270.
6. Newsweek, Inc. Buyers of New Domestic and Import Cars, 1977, Table 3.
7. Motor Vehicle Manufacturers Association (MVMA), Motor Vehicle Facts and Figures '78, Detroit, 1978, p. 34.
8. L.B. White, The Automobile Industry Since 1945, Harvard University Press, 1971, p. 145.
9. P.E. Green and P.W. Rogers, Study of Consumer Automotive Preferences with Regard to Fuel Economy Measures, Rogers National Research, Inc. Report DOT-TSC-NHTSA-73-38, September 1978, p. 7.
10. Motor Vehicle Manufacturers Association (MVMA), Motor Vehicle Facts and Figures '78, Detroit, 1978, p. 9.
11. G. Schink and C. Loxley, The Wharton EFA Automobile Demand Model Volume 1, Final Report, DOT-TSC-NHTSA-79-49.I, U.S. Department of Transportation, Transportation Systems Center, July 1979, Section 1.4.3.

12. Charles River Associates, Assessment and Improvement of Motor Vehicle Demand Model Subtask 2A Report. Annotated Bibliography. Prepared for TSC June 1979, p. 99.

13. K.H. Schaeffer and Elliott Sclar. Access for All-Transportation and Urban Growth. Penguin Books, 1975 Chapter IV and VII.

14. Cambridge Systematics Inc., NSF's 1978 National Transportation Survey. Data Tape Printout April 1979. Card 9, p. 16.

15. U.S. Bureau of Census News Releases, (John Cannon) February, 1979.

16. J. Lansing and G. Hendrix, Automobile Ownership and Residential Density, University of Michigan, June 1967, p. 13.

17. Cambridge Systematics, Inc./Westat, Inc. Assessment of National Use, Choice and Future Preference Toward the Automobile and Other Modes of Transportation. Prepared for NSF. June 1978. Volume I, p. 6-36.

18. Wilbur Smith and Associates, Comprehensive Traffic and Transportation Inventory. Boston Regional Planning Project. September 1965.

19. U.S. Bureau of the Census, Current Population Reports. Report series P-25 number 704. July 1977, Table 8.

20. U.S. Bureau of the Census, Statistical Abstract of the United States-1978. Washington, D.C., 1978, pp. 29, 43, 442. All annual growth rates are for 1970 to 1977.

21. TSC: Motor Vehicle Sales and Prices-May 1979 Memorandum, June 30, 1979.

22. U.S. Bureau of the Census, Statistical Abstract of the United States - 1978, Washington D.C. 1978, p. 45.

23. University of Michigan, 1977 Survey of Consumer Finances. Motor Vehicle Tabulations. Tables D-5 and D-5a.

24. "Chrysler's Big Mistake," Consumer Reports, July 1978 p. 376.ff.

25. Cambridge Systematics, Inc./Westat, Inc. Assessment of National Use, Choice and Future Preference Toward the Automobile and other Modes of Transportation. Prepared for NSF June 1979. Volume I, p. 5-55.

26. Market Facts, Inc., An Analysis of Average Annual Miles Traveled. Prepared for NHTSA. August 1978. p. 11.

27. U.S. Bureau of the Census, Current Population Reports. Reports Series P-60, No. 117, December 1978. Table A, p. 2.

28. U.S. Bureau of the Census, Statistical Abstract of the United States-1978, p. 404.

29. Cambridge Systematics, Inc./Westat, Inc., Assessment of National Use, Choice and Future Preference Toward the Automobile and Other Modes of Transportation. Prepared for NSF June 1979, Volume I, p. 5-55.

30. Cambridge Systematics, Inc./Westat, Inc., Assessment of National Use, Choice and Future Preference Toward the Automobile and Other Modes of Transportation. Prepared for NSF June 1979, Volume I pp. 5 - 22-25.

31. American Public Transit Association, Passenger Transport, Volume 37, No. 23, June 8, 1979, p. 1.

32. Newsweek, Inc., "Buyers of New Domestic and Import Cars, 1977," Table 90.

33. Newsweek, Inc., "Buyers of New Domestic and Import Cars, 1977," Tables 82, 86, 92.

34. Cambridge Systematics, Inc./Westat, Inc. Assessement of National Use, Choice and Future Preference Toward the Automobile and Other Modes of Transportation. Prepared for NSF. June 1979, Volume I, pp. 3, 33-37.

35. Cambridge Systematics, Inc./Westat, Inc. Assessment of National Use, Choice and Future Preference Toward the Automobile and Other Modes of Transportation. Prepared for NSF. June 1979, Volume III, pp. 3, 1-40.

36. Charles River Associates, Assessment and Improvement of Motor Vehicle Demand Model. Subtask 2A Report. Annotated Bibliography Prepared for TSC. pp. 94-99.

37. National Analysts, Consumer Behavior Towards Fuel Efficient Vehicles First Cycle, Prepared for NHTSA, July 1978.

38. National Analysts, Consumer Behavior Towards Fuel Efficient Vehicles. Automotive Fuel Economy Contractors' Coordination Meeting December 11-13, 1978. Summary Report. Prepared for NHTSA.

39. Market Facts, Inc., A Study of Consumer Behavior Towards Fuel Efficient Vehicles. Prepared for NHTSA. Interim Report. June 1979.

40. Charles River Associates, Consumer Behavior Towards Fuel Efficient Vehicles. Prepared for NHTSA. Final Report. April 1979.

41. University of Michigan, 1977 Survey of Consumer Finances, Motor Vehicle Tabulations, D6-D10.

42. U.S. Bureau of the Census, Current Population Reports, Report Series P-60, No. 117, December 1978, Table A, p. 2.

43. U.S. Bureau of the Census, Current Population Reports, Report Series P-25, No. 802, Table B.

44. U.S. Department of Commerce, Weekly Business Statistics, June 29, 1979, p. 2.

45. U.S. Bureau of the Census, Current Population Reports, Series P-25, Report 805, Table E. May 1979.

46. U.S. Bureau of the Census, Current Population Reports, Series P-20, Report 338, May 1979, Table D.

47. U.S. National Center for Health Statistics, Monthly Vital Statistics Reports. Final Fatality Statistics for 1976 and 1977. - Advance Reports.

48. "Xerox Up-sizes with Vans, Full Size Cars to Meet Needs," Automotive Fleet, Volume 18, No. 7, May 1979 pp. 25-30.

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